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OF

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Announcement

THE Quarterly Journal is a periodical maintained by the University of North Dakota. Its primary function is to represent the varied activities of the several colleges and departments of the University, tho contributions from other sources are welcomed when they are the fruitage of scientific research, literary investigation, or other form of constructive thought. Correspondence is solicited.

All communications should be addrest,

THE QUARTERLY JOURNAL,
University, North Dakota.

Editor's Bulletin Board

THE January, 1915, number of the Quarterly Journal will represent the political and social sciences. The following list of writers and subjects suggests an interesting number:

Dr. Henry, late Dean of the Law School, writes on the English Bar. Dr. Bek, of the Department of German, discusses the work of the Germans in North Dakota, Dr. Davies, of the Department of Sociology, has spent a portion of his vacation in investigating the conditions of life in some of the prominent jails of the state, and will write upon his findings. Professor Birdzell, for two years Chairman of the State Tax Commission and now again Professor of Law, will write of the work of the Tax Commission. Mr. Sveinbjorn Johnson, of the Department of Economics and Political Science, will discuss the matter of legislative procedure in North Dakota. An article on the extension movement may also be expected from Mr. J. J. Pettijohn, last year's Director of the Extension Division, now with the University of Indiana in a similar work. In addition to these we have a provisional promise of an article from President McVey.

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THE REGISTRAR,
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The Quarterly Journal

VOLUME 5 OCTOBER, 1914 NUMBER 1

The Medicine Man and Some of His Modern Successors

HARVEY ELLSWORTH FRENCH,

Professor of Anatomy and Dean of the School of Medicine, University of North Dakota

THE subject of this essay was suggested by a criticism of the medical profession contained in a letter that came to my office a few months ago. It was there frankly but good-naturedly stated that "the physician has in all ages been the first cousin of the Medicine Man of the Indians." The following discussion is by no means an effort to deny or to answer the charge. At the best the modern physician is an evolution from the medicine man, or witch doctor, and one needs to look into the history of medicine but slightly to know that there is something in the criticism, using the words physician and medicine in a broad sense. Garrison says:[1] "The history of medicine is also the history of human fallibility and error." It is only when one studies limited portions of that history, the life and works of certain men, and the story of advancement in the science, that the prospect is any brighter. This study is an effort to point out some of the likenesses and some of the differences between primitive medicine and things done and thought in the name of the healing art today.

A corollary of the well accredited doctrine of the unity of folklore is the opinion of historians that the beliefs[2] and practises regarding disease and the relief of suffering have been similar in all ancient and primitive peoples. The most primitive man no doubt shared with the animals such instincts as seeking shelter from the cold and the storm, seeking shade from the sun, favoring an injured part, and destroying obvious parasites. When man began to be more conscious of the parts and the powers of nature, he looked upon them all with wonder and reverence. All nature was supernatural. He worshipped sun, moon, stars, trees, and rivers. The fierce heat of

1. Garrison: History of Medicine, p. 26.
2. The outline of primitive medicine here given follows the discussions of Garrison, Gorton, and Davis.

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the sun, the raging storm, the thunder and the lightning were the manifestations of offended gods or demons. Disease most naturally fell into the same classification and was thought of as a demon or as the work of supernatural agencies of some kind; it was not something to be treated, but like other gods and demons was to be placated by offerings and sacrifice. With more experience, perhaps the effect of dreams and of seeing persons with oddities of body or feature, there were added to the conception of disease the work of the spirits of the dead and the work of spirits controlled by persons with supernatural powers. There were added to the attempts at placation efforts to cajole, outwit and frighten, and magic and sorcery were born. Men sprang up who were cerdited with having power over these spirits of disease; these were the medicine men, and priestcraft and witchcraft were born. The practise of the medicine man consisted of hideous disguises, shouting, raving, dancing, and doing any of a hundred fantastic things, all of which were considered as "making medicine." He might pretend to draw the pain out with his hand, to suck it out with a straw, or to cough up an imbedded arrow point. To prevent disease and its recurrence he provided fetishes and amulets. His efforts were nominally to out-magic or to cajole or to frighten the spirit of the disease; in reality they operated to impress the minds of the people and if they had any effect upon the disease it could be only thru suggestion. In some tribes medicine men were only agents of vengeance; in some their efforts were general, for the community or the tribe, leaving the care of the individual sick to the wives and mothers; in some they were highly revered, and were priests, prophets, leaders, and warriors as well.

There also sprang up folklore, a large part of which had to do with the explanation and the cure of disease. This grew from generation to generation and with association with other tribes, and it centered itself around the medicine men, the "witch doctors" and the "wise women." A large part of it had to do with plants and poisons. The number of drugs used by fairly primitive man was very great. The materia medicas of ancient Egypt and ancient China,[3] old at the dawn of history, would compare very favorably in extent with those of later times. The American Indian[4] used "arbutus for rheumatism; lobelia for coughs and colds; wild sage tea, golden seal, flowering dogwood, and prickly ash berries for fevers; elder, wild

3. The materia medica of ancient China included "elephant's bile, dried spiders, bugs, toads, lizards, snakes, claws, ears, tongues, hearts and livers of numerous animals, excrement, dragon bones, cotton, ivory, musk, rheubarb, gentian and camphor." (Baas) quoted by Davis's History of Medicine, p. 12.

4. Garrison: History of Medicine, p. 21.

cherry, and sumac for colds and quinsies; wild ginger, ginseng, and euphorbia for digestive diseases; sassafras and violet leaves for wounds and felons; and the roots of sassafras and sarsaparilla for "cooling and purifying the blood." They also made use of emesis and catharsis, massage, hot baths, vapor baths and cold plunges. Some of the Indian's medicines and methods were already known to the white man; many were new and were adopted into the folk medicine and into the pharmacopoea of the invading race. Primitive peoples seem always to have known the deadliest arrow poisons —curare, ouabain, veratrin; they also knew such powerful drugs as opium and hashish. They knew the preserving effects of salt, dryness, smoke, honey, and wine. They knew and used alcohol, tobacco, tea, coffee, and cocoa. Needless to say that many of the drugs and methods of primitive man have come down to us; some are useful, others are not. To him, however, the value of the substances used in the cure of disease depended largely upon where they grew or were found, the time and circumstances of their gathering, by whom and how prepared and administered, the time of being taken, e.g., fixed ritualistic periods for emesis and catharsis. The use of a plant as a medicine was often suggested by some fancied resemblance in shape or color of root, stem, leaf, or fruit to some part of the body. The use of a stone was brought about by some characteristic that appealed to the imagination. The peculiar value of certain meats and the use of remedies prepared from animals, birds, and insects were dictated by the most striking attributes of the creature in question. More general folklore added a thousand fantastic things, such as the negro superstition of pegging a hank of the patient's hair into a tree in order to transfer chills and fever to the tree or its owner.

Enough has been said to show that primitive medicine was at all times intimately associated with the religions and the superstitions of the times. It knew many drugs and magical customs. Some of its drugs were powerful and some of its remedies useful. It no doubt obtained physiological as well as toxic effects. In the mass of its therapeutics, however, it must be doubted whether nature was not more hindered than helped by its efforts. Suggestion or psychotherapy played its part. The belief in the efficiency of any remedy, aside from the dictates of superstition and folklore generally depended upon the superficial or discontinuous reasoning of *post hoc ergo propter hoc*. Primitive surgery and obstetrics, while characterized by the same features, need not be discust for the purposes of this

paper. The philosophies of later Greece do not belong to this discussion.

Volumes might be written, in fact have been written,[5] simply to enumerate the superstitious and ridiculous things that have been done at all times in the name of medicine. The literature, both lay[6] and medical, of any century shows a thousand things that might well put primitive medicine to shame. Jean Raynaud, a Paris physician of about 1600, quoted by Sollmann,[7] enumerates as drugs of that time, swallows, old scorpions, brains of sparrows, and many other things of the kind, human skulls, human bones, mummy, and the excrement of various animals, as well as many drugs that would be recognized as such today. He inveighs against amulets, conjurations, and the like which were common in that day, but approves of little bags of medicine, such as the root of the peony and hound's tongue hung about the neck for certain conditions. He gives a prescription containing 65 ingredients. "There is nothing men will not do," says Holmes,[8] "there is nothing they have not done to recover their health and save their lives." Medicine has given the world its sciences and its scientists, it has done much to preserve life and relieve suffering, but in the folk mind and in the things done by the wise and the foolish the methods of the medicine man have always played a large part.

What remnants of primitive medicine exist in the civilized world today?

1. Perhaps the first example to be thought of is the existence of certain well known systems of mysticism and idealism, the successors of a long chain of personal cults or philosophies that extends back to the days of primitive man. One has come and gone in this generation, others still remain and are strong. Just what will be their future or when will be the end of such cults no one can tell, with the mind of man such as it is on the one hand and the advance of scientific knowledge on the other. The healers of these cults are quieter in their methods than were the medicine men, but like them

5. E.g. Black: Folk Medicine (Cited by Garrison).

6. Cf. for example, the use of the Royal Touch for the king's evil (Macbeth, Act IV., Sc. 3); the night gathering of "enchanted herbs" (Merchant of Venice, Act V., Sc. 1); "the toad ugly and venomous" with "a precious jewel in its head" (As You Like It, Act II., Sc 1); "how the fever was cured by a spider shut up in a nut shell" (Evangeline); an allusion to the medieval weapon-salve in **Hudibras,**

"strange hermetic powder
That wounds nine miles point blank would solder,
By skilful chemist with great cost
Extracted from a rotten post";

the images of diseased parts carried to the shrine in Heine's **Die Wallfahrt nach Kevlaar.** For a recent charming description of a pilgrimage to Lourdes see **A Corner in Harley Street,** Chapter XVII.

7. Sollman: Nu Sigma Nu address, 1912.

8. O. W. Holmes: Medical Essays, p. 378.

their efforts are calculated only to impress the mind and, like them, they depend upon suggestion. Scientific men would not at all deny that what we call psychotherapy always has had and perhaps always must have a large place in the treatment of disease. Extreme mental anxiety may bring about dyspepsia and chlorosis, may be the factor that will make a person succumb to tuberculosis or other infection or otherwise depress the health of body and mind. There is much truth in the maxim from Coleridge "The best inspirer of hope is the best physician," and poise of mind is to be striven for by all means. The criticism of the modern physician is that, like the medicine man of old, the healer denies the truths of real science and stands in the way of progress. Psychotherapy,[9] reduced to true science and working in harmony with all the laws of nature governing life and health, will no doubt prove its worth, but it cannot mend a broken bone, remove a cancer, or heal a specific infection.

2. Beliefs in amulets, conjurations, and ridiculous causes and remedies based upon superstition, folklore, and the superficial reasoning of the primitive mind are by no means things of the past. Nor need one go to literature or to the negro to find examples of them as everyone no doubt knows. A few instances the writer has observed in living men and women are: that rheumatism can be cured by carrying a small potato in one's pocket; that warts can be removed by conjuration; that oil tried out of earthworms will make one supple; that the red color of a cloth about a child's neck is good for colds and sore throat; that a black ribbon or string of black beads in the same way will keep off certain diseases; that whooping cough will disappear only upon the coming or the going of the leaves of the trees; that holding the flexed and adducted thumb inside of the fingers will ward off the bite of a mad dog; that a poultice of cow's dung is the best treatment for blood poison; and that the eating of tomatoes will cause cancer.

3. As a third example of remnants of primitive medicine may be mentioned obstructions that are thrown in the way of scientific medicine and its advancement. There is a widespread horror of dissections and postmortem examinations, due partly, at least, to the primitive fear of offending the dead and the primitive feeling that the human body is more sacred when dead than when alive. There is opposition to operations on the part of some as a thing that might

9. To indicate that scientific medicine is not thoughtless of the relation of mind to the body and its functions two very recent studies may be cited:—Cannon: The Emergency Function of The Adrenal Medulla in Pain and The Major Emotions, Am. J. Phys. 1914, XXXIII, 356, and Crile and Lower: Anoci-Association. 259 pages, 1914, W. B. Sanders Co.

interfere with the resurrection. There is objection to physical examinations, to animal experimentation, and to other methods of study that speaks for a lingering prejudice in favor of faith cure, and a feeling that one who is able to cure need not ask questions or make investigations but must have magical ways of knowing and doing the necessary things. There are those who object to any and all scientific treatment, preferring to trust to prayers or to their healers. These people seem unable to realize that the God whom they worship as the Creator of the Universe works with material things and according to laws, and that a truer office of prayer would be to ask for guidance in learning those laws and wisdom in choosing and applying a remedy. There is objection to such well-tried practises as vaccination, the use of diphtheria-antitoxin, and the establishment of quarantine, surely because some minds fail to grasp scientific facts.

4. Under this head I shall consider several items that are suggested by the world-old belief that I have heard more than once from the lips of a layman: "There must be a cure." Is there defect, distress or disease anywhere—then, as a corollary nature must have provided a cure and someone somewhere must know what to give or what to do.

Parenthetically it should be said that the popular conception of the word cure should be revised. There may be a cure but it is generally very different from the common lay notion that it may be brought about by some simple remedy or manipulation if only the person with the knowledge of that magical means can be found. In surgical conditions it frequently happens that a cure may be obtained rather simply. In the field of internal medicine there are comparatively few diseases that can be cured by a single or simple treatment, and physicians often say that the specifics can be counted on the fingers. For the greater part a cure means a favorable outcome in a conflict between the causative factors of the disease, be they infection, degeneration, traumatism, or what not, and the vital forces of the patient. A cure sometimes means only an arrest of the active manifestations of the disease; the patient survives, and escapes a recurrence or not as the case may be. A cure often, perhaps generally, involves scars; the patient survives but the hand that was crushed is gone, or the heart that was touched by rheumatism must always betray its lesion. A cure is not always to be expected; in certain lower animals nature is able to restore a lost extremity or to do even better than that; in man she cannot do so, and with due allowance for the work of Carrel, surgeons will probably never be able to do such extensive gratfing. In the same way

old arteries cannot be made young, large destructive lesions cannot always be obliterated. The vital forces may be given assistance that is more or less beneficial or even necessary in the conflict. The help supplied under good treatment amounts to giving the vital forces a fair show; reinforcements in the form of antitoxins and specifics are given if they are known. But modern medicine recognizes that not only is prevention better than cure but it is almost infinitely easier and more effective. Prevention is the field par excellence for specifics and the wisest efforts at cure in the long run consist of trying to discover nature's laws and of leading the individual and society to live in harmony with them.

But to return to the primitive notion that there must be a cure somewhere for every ill: at its best it is part of the motive that inspires scientific medical research, at its worst it plunges man into a lot of folly.

It makes possible, first of all, the whole system of patent medicines, than which nothing could well be more foolish or fraudulent. Symptoms should be interpreted as warnings that we art out of harmony with certain of nature's laws; the wise thing to do should be obvious. Woods Hutchinson speaks of headache as the most useful pain in the world. There may be something wrong with our eating or drinking, our dress, our ventilation, or our habits of work; heredity may be at fault, or infection may have secured a foothold. In any case there are rational things to be done for the safety of the individual and the race. Interpretation, however, is not always easy, and skilled advice seems expensive. If it were something wrong with a fine watch or an automobile we should employ skilled service. In the same way if the illness were enough to be worth while we should have skilled treatment, at least we should consider it along with faith cures and quacks. In the meantime we have already discovered that the doctor's medicines do not work magic and his advice is always difficult to follow. It is so much easier to take our diagnoses ready made, often even the suggestion that we are ill at all, from the newspapers and the almanacs. Samuel Hopkins Adams[10] estimates that the people of the United States spend every year for patent medicines about $75,000,000. Even statesmen, literary men, college professors, and ministers are deceived. The whole business smacks strongly of the methods of the medicine man; diagnoses are not made at all; remedies are prepared in secret and are all the way from useless to positively harmful and habit forming; use de-

10 S. H. Adams: The Great American Fraud, 1905, P. F. Collier & Son.

pends upon large promises, supposed good results, upon suggestion and superficial observation. Surely we can say of patent and proprietary medicines as Oliver Wendell Holmes[11] said of the materia medica, with certain exceptions, as used in his day, if all "could be sunk to the bottom of the sea it would be all the better for mankind and the worse for the fishes."

In the same way there flourish hundreds of men pretending to cure disease who are utterly deceived, or untrained, or who are so unscrupulous that they are willing to profit by the easy methods of quackery. There are self-styled specialists who travel and advertise, managers of fraudulent health resorts, promoters of worthless cures, and irregular and drugless healers of several well known varieties. The training of these men is variable. Of some it is fair no doubt, in which case so much the worse for their principles; of others it is little or nothing and their degrees are fraudulent; of a very large part it is from one-tenth to one-half the training of a regular physician and consists of a miximum amount of dogma and theory and a minimum amount of scientific work. There lie upon my desk sample correspondence lessons and advertising literature from a school of one of the drugless sects that is critical of regular medicine. The lessons, upon the elementary subject of anatomy and upon points about which there is no dispute, are full of mistakes that a first-year medical student would recognize. The advertising matter points out that, while for regular medicine the entrance requirements are high, the course long, and the profession over crowded at best, for this work anyone with only a fair education can take it up, master it even by correspondence in a short time, be able to handle all kinds of diseases better than a regular physician, and be sure of large financial returns from the start. The largeness of the place in modern treatment of disease taken by men of this kind is surprising; but it depends upon the same faulty reasoning and judgment that makes patent medicines possible. Again people of every class are deceived. I recently knew a successful business man who took his wife a long distance to consult an advertising cancer faker after so eminent authority as the Mayos had diagnosed the condition incurable cancer. Due chiefly to efforts within the medical profession, the poorly trained man who can use the title of M.D., the man with the fraudulent degree, and the advertising and itinerant quack are rapidly passing. The drugless healers, however, are still fairly able to hold their own before the people and before legislative bodies.

11. O. W. Holmes: Lecture before Harvard Medical School.

It is difficult for the laity to realize that medical practise acts requiring thoro scientific training of all who attempt to diagnose and treat disease are for the benefit of the people.

Again the hope of quick and easy cure gives commercial value at least, and at times psychotherapeutic value to many things about the physician quite apart from his scientific knowledge and ability. Personality and self confidence are often given the preference over training and skill. A reputation well established is a splendid asset, and distance properly arranged is better still; if the doctor received his training in an enchanting world, or if he lives so that he must come from such a world or the patient must make a pilgrimage to see him his advantage is very great.[12] The physician is often enthusiastically praised or as strongly censured for what he is not at all responsible.

But is there not something primitive, at least medieval, about the doctor himself and his training? The form of his prescription, his materia medica and misunderstood parts of his code of ethics are sometimes pointed to as evidence that there is.[13] The modern materia medica truly comes down from very ancient times. There have been additions and omissions from time to time, but it has drugs that come down from ancient China and the American Indian. Some of the oldest parts are most valuable, much of all parts is useless, but it need not be thought that the worthless portions occupy any part of the student's attention or enter into the physician's armamentarium. A certain amount of empiricism could also be laid at the physician's door but it is very different from that dictated by folklore and superficial judgment. Quinine and mercury had long held well established places based upon the observation of the best practise, but they were just as valuable fifty years ago as they are today when we know how and why they act, tho we are glad of the later knowledge and can now use them more intelligently. Aside from these things, however, and extravagant judgments of him and his work by the laity at times, and individual yielding of temptation to use the means of quackery in some, perhaps, I think there is nothing of the medicine man about the modern physician. He brings to your service simply the conscience and sympathy of an educated man, a certain amount of accurate knowledge and trained judgment. He is committed to no dogma or theory but is anxious to know the whole truth of nature's laws regarding life and death, health and disease.

12. See an article on "Twilight Sleep," one part good and five parts sensational in McClure's for June, 1914.
13. See a criticism in McClure's for January, 1914.

He has at his command not only "the knife" and "drugs and mineral poisons," but vaccines, antitoxins, baths, massage, dietetics, psychotherapy, and everything that the best practise and the best scientific research can supply. His prescription, changing in the direction of simplicity, aims at an accurate and scientific language, not at mysticism. His secrecy, surely not of the gospel of hygiene and sanitation or of anything that will benefit his patient, is no more than good judgment would dictate for any work. The spirit of his ethics, tho old, means intelligent service. "I will follow that system of regimen which according to my ability and judgment I consider for the benefit of my patients and will abstain from whatever is deleterious and mischievous."[14]

The modern physician is an evolution from the medicine man, but so is the minister and even the teacher, the statesman, the judge, and the warrior. Modern medicine is an evolution from the superstition and the folklore of primitive man, but so are astronomy, chemistry, physics, biology, and the social sciences. Modern medicine looks back to a long line of illustrious men, to many of whom the other sciences are also indebted: Aristotle, Linnaeus, von Helmholtz, Cuvier, Huxley, and Leidy were trained as physicians. The well known triumphs[15] of medicine in recent years have gone hand in hand with progress in the other sciences. Only the parallel development of all can be expected in the future. With the well established scientific basis that medicine now enjoys, with the growth of popular interest in hygiene and sanitation, with the modern emphasis upon public health and preventive medicine and the tendency to socialize the work of the physician, larger numbers than ever before of the very highest type of young manhood are being attracted to the profession; with the same conditions, too, I think we may hope for a steady decrease in the methods of the medicine man.

14. From Oath of Hippocrates.
15. See Victor C. Vaughn: The Service of Medicine to Civilization. President's Address, 65th Annual Session, A.M.A. Journal A.M.A. June 27, 1914.

Notes on the Photographic Intensity of Sunlight

EDWARD BEATTIE STEPHENSON,

Assistant Professor of Physics, University of North Dakota

INTRODUCTION

SOME unusual results in making photographs at various times of the year in North Dakota as compared with previous experience in Illinois, and the fact that the intensity of the light has an important bearing on such widely separated subjects as photography, the weather, plant growth, and wireless telegraphy, led the writer to undertake a brief study of the hourly, daily and seasonal variations of the photographic intensity of the sunlight in North Dakota.

The total energy received from the sun may be roughly classified according to its distribution in the spectrum into three overlapping regions:

1. The visible—a relatively narrow range of short wave lengths to which the human eye is sensitive, showing the colors of the common spectrum,

2. The infra-red—covering all the region of longer wave lengths below the red, the region of the heat rays,

3. The ultra-violet—covering all the region of shorter wave lengths above the violet, the region of the so-called actinic rays or those which affect a photographic plate.

A complete study of this total energy would require the use of some form of pyrheliometer[1] and more facilities than were available, but a fairly accurate study of the relative photographic intensity of the sunlight is much simpler, gives just the information necessary in photographic work and is probably a factor in the ionization that affects wireless telegraphy.[2] What function the light of short wave-length plays in plant growth has not been exactly determined, but ultra-violet light certainly accelerates many chemical reactions.

Experience with students and the statements of commercial photographers clearly warrant the conclusion that the chief difficulty of the amateur and even of the professional who works under widely varying conditions, is in obtaining correct exposures. Attempts have therefore been made to correct, in the dark room, the errors made in

1. Science, May 6, 1914.
Astrophysical Journal, v. 39, p. 35, 1914.
2. A. H. Taylor Phys. Rev. v. 3, p 346, 1914.

the field, and handbooks are full of development formulae, of corrections for over exposure or under exposure, of instructions for reducing or intensifying or otherwise "doctoring" a negative. It seems to be pretty well established, however, that such corrections are more apparent than real and that the only way to get the best possible negative is to give the correct exposure in the first instance. With a correctly exposed plate any one of a dozen developers will give a normal negative and it certainly seems that the emphasis should be placed on making a correct exposure rather than on an attempt to correct an improper one, tho of course special conditions may arise when one must merely do the best he can.

To make a correct exposure requires primarily a knowledge of the photographic intensity of the light. The human eye is very sensitive to variations in light intensity or color, but not at all a good instrument for determining the absolute values. This requires some mechanical means of mesurement. The method devised by Watkins[3] is simple and convenient for general work and involves the use of a meter that considers four factors—the light, the diafram opening or stop, the plate speed, and the exposure time. The plate speeds are a series of arbitrary numbers experimentally determined, the stop is set on the camera, the light is determined by the time it takes a strip of sensitized paper to darken to a standard shade, and the exposure time is taken from the scale of the meter when the other three factors are known. To the beginner in photographic work some such method is essential in training the judgment and acquiring experience, and for anyone who works under varying conditions it is a material aid.

METHOD OF INVESTIGATION

The apparatus used in this investigation was a Watkins Bee Meter whose essential principle is that a small strip of a sheet of especially sensitized bromide paper can be exposed at each test and the time it takes to darken to a standard shade noted. This time gives only the relative intensity of a series of determinations, but if at any time the absolute value of any one is known the others are then determined. The method is probably accurate to within 20 per cent. and this is amply sufficient for photographic work because of the wide latitude of modern plates or films. To determine the variation of different sheets of sensitive paper of the same batch and of different batches, the last few strips in one sheet were compared with the first few of the next in the same batch and then one sheet

3. Photography, by Alfred Watkins, p 5.

from each batch was saved for comparison at the end of the test. The variations were irregular and within 10 per cent of the mean. During the same period the meter readings were being taken, several hundred plates and films of different brands and speeds were exposed under carefully chosen conditions and thereby the plate speeds to be used with the meter were determined.

The general method of collecting data was to take a series of hourly readings of the direct sunlight and of the clear light from the north sky thruout the day about once a week and to check the readings between 10 A. M.. and 3 P. M. nearly every day. The readings for each month were plotted on a large scale and a smooth curve

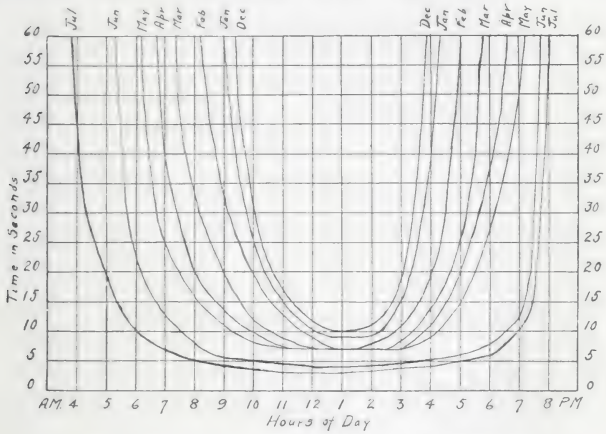


Fig. 1. Direct sunlight curves from Dec. to July. Exposures are directly proportional to the time in seconds.

drawn that came the nearest going thru all the points. This gives the average for the month. It is generally assumed that the curves from the shortest to the longest days are symmetrical with those for the other half year. The sunlight curves from December to July inclusive are given in Fig. 1 where the time it takes the paper to darken is plotted as ordinates and the hours of the day are plotted as abscissae. The curves for the light from the clear north sky are similar in shape to those for the direct sunlight and between the hours of 9 A. M. and 5 P. M. have approximately three times the meter reading.

DISCUSSION OF RESULTS

The curves of Fig. 1 increase in width and depth from December to July, the irregularities probably being due to the fact that the weather did not always permit taking the readings on exactly corresponding days each month and this would tend to throw the average towards the first or last of the month. The axis of symmetry of the curves is about 12:45 P. M. due to the fact that Grand Forks is near the western edge of the Central standard time belt and the standard time is therefore fast compared with the solar time. The morning and afternoon branches of the curves are not symmetrical, the former rounding more gradually while the latter rise very steeply. It is not unusual, just before sunset, for the meter reading to increase ten fold in thirty minutes altho the light still seems quite bright. The minimum for December is approximately three times the mini-

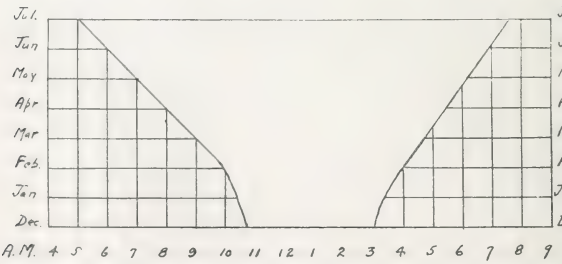


Fig. 2. The light portion shows the hours for each month during which a snap shot exposure may be made in full sunlight with ordinary ro film and camera wide open.

mum for July and the latter curve is nearly three times as broad and very flat for 10 hours during the day. It is not possible from these data to make an exact statement of the relative total quantities of solar energy received in December and June but the curves indicate that there may easily be a factor of ten when we consider the greater number of clear days in the latter month. This is of great importance in agriculture and indicates how crops may mature during the short growing season because they receive such large quantities of energy at the time when they need it most.

The factors, light, stop, and exposure have a fixt mathematical relation when proper units are chosen but the plate speed has to be determined experimentally. Those on the Watkin's meter are presumably adjusted for England where the atmospheric conditions are very different, and the writer has found that in North Dakota

the numbers may safely be doubled and that good negatives may be obtained at five times the listed plate speed or one fifth the indicated exposure. However it is better to err on the side of over rather than under exposure and in case of doubt give more time.

To illustrate the practical use of the curves in Fig. 1 an example may be taken. Suppose that a good negative has been obtained by an exposure of 1/5 sec. on January 5th at 10 A. M. The January curve at 10 A. M. shows that the meter reading was 25 sec. What would be the proper exposure under the same conditions, i.e., the same camera, plate, stop and subject on June 10th at 4 P. M.? This is 1/5 of the former reading so the exposure may be 1/5th of the former or 1/25th of a sec.

If we assume that the ordinary camera makes a so-called instantaneous or snap shot in 1/20th of a sec., that the wide open stop is U. S. 8 or f/11 and that ordinary roll films are used, Fig. 2 gives the range of hours for each month during which snap shots may be safely taken in full sunlight. The light portion shows the time during which pictures may be taken and the shaded portion the time during which they may not be taken. Of course with large lenses and rapid plates these limits may be exceeded, but one should not expect to take "snap shots indoors or on a dark day" with a cheap camera.

Because of the difference in the range of sensitiveness of the eye and the photographic plate the amateur ordinarily does not appreciate the wide range of exposure necessary, especially in interiors, so the following table [4] is given to be used in conjunction with the curves of Figs. 1 and 2. The values for direct sunlight are to be multiplied by the factor given.

Subject	Factor
Open landscape in sun	1
Landscape, heavy shadows	5
Under trees	500
Bright interior	300
Dark interior	5,000
Artificial light, interior	50,000
Portrait in open air	5
Portrait in well lighted room near window	50
Portrait in ordinary room	200

To illustrate the use of this table the example given above may be continued. If the June picture were a portrait in a well lighted

4. H. K. Burton's Exposure Table revised for local conditions.

room instead of a landscape in the sun, the 1/25th sec. should be multiplied by the factor 50 giving 2 sec. as the proper exposure. The effect of fresh snow on the ground is to considerably reduce interior exposures because of the diffsued light.

CONCLUSIONS

The relative photographic intensity of the direct sunlight and of the clear north sky in North Dakota has been determined from December to July, and curves are given showing the average for each month.

Plate speeds have been tested at the same time for various brands of plates and films and it was found that the numbers on the Watkins scale may safely be doubled in calculating exposures, the relative values of the different kinds remaining the same.

Tables with illustrative examples are given showing the use of the curves in calculating exposures.

Engineering

ALBERT JOHN BECKER,

Professor of Applied Mathematics and Mechanical Drawing, University of North Dakota

THE age in which we live has aptly been termed the age of iron and steel. The remarkable achievements of the past half century have brought us to the point where we are no longer amazed or incredulous when new inventions are announced. We seldom say, "It is impossible." And with our matter-of-fact acceptance of new discoveries is our equally matter-of-fact assimilation of them for business or for pleasure. We are constantly on the alert, ready to utilize a new convenience or a more perfect process.

So the engineer has come to take a vital part in the life of today; unheralded, he has developed with his development of inventions, with the multiplication of conveniences and luxuries. The one has fostered the other; the demand has brought forth the fertile brain to construct and direct. The age of steel is the age of the engineer.

The word engineer has been in common use for many centuries. Its origin has been traced to the Latin *ingeniosus* (*ingenium*)—naturally clever, able, ingenious. Its early use was confined to military service. Men engaged in the construction of fortifications, siege-works, roads, bridges, and military machinery, services requiring skill and knowledge, were called engineers.

The following qualifications of an engineer have been taken from a book published in England about 1640 and will be found very interesting and applicable today:

(1) "He is to be religious, for the fear of the Lord is the beginning of wisdom."

(2) "He is to be a souldier, for none can better judge of the sufficiency or insufficiency of fortifications."

(3) "He is to be a traveller, for he that hath not seen variety of works and the excellency of forreign fortifications, cannot perceive the defects of ours, nor give directions to rectify them."

(4) "He is to be well versed in the Arithmeticke for his calculations; in the Geometry, for the setting out of all superficies; in the Architecture, for to direct all manner of artificers; and in the other parts of the Mathematikes for the taking of distances, depths and elevations, and for the inventing and contriving of all manner of engines and machines of warre."

(5) "He is to be wise in all his proceedings, punctuall in all his promises, careful and diligent in his calling and rather inclined to austerity than lenity or otherwise he will never be respected, served or obeyed."

(6) "He is to be of solid judgment and quick of apprehension to judge aright of the defects and advantages of places. He is not to give account of his actions to any but to the General or to the Lieutenant General of the Ordnance; if he be in an Army or in a Garrison, only to the grand Committee, and to the Governor; and as for all other kinds of men, inhabitants, souldiers or officers; he is not bound to expostulate the case, if they demand of him reasons for anything he directs or commands to be done; neither ought he if he regards his reputation and makes conscience of his ways, to comply_____ with the humour of the greatest in authority, or be led to assent to any resolution that is against the maxims of his art, by the Logical and Sophisticall reasons and arguments of Scholars or Churchmen, for some of them are now-a-dayes overbusie in things that go beyond their element and endeavor to oversway Artists by rhetorike, considering not that their reasons are no reasons at all to the reasons of art. And this last quality is the essentiall part of a good engineer, for all the others are but to small purpose without this."

With the fall of the feudal system, there sprang up a new line of work in land mesurement and location. Those who did this work styled themselves engineers and later were called civil engineers, to distinguish them from the military engineers. It is interesting to note that the first development of engineering, other than military, was what we today still call civil engineering. The first great impetus, and the beginning of several other branches of engineering, came at the time of the industrial revolution in England. At this time we note the invention of the spinning machine and power loom, the steam engine, the locomotive, the casting and rolling of iron, followed by experiments in electricity and a host of minor inventions.

Any one can build some kind of a bridge, or building, or machine, but it is the province of the engineer to build better and cheaper than the others. His is the knowledge that has been gained from experience, a knowledge of the action of the forces of nature, of the behavior and strength of the various materials available for construction. By virtue of his understanding of the principles of the industrial sciences, he is able to solve commercial problems. He is an analyst, can classify his conditions, coördinate his data and recog-

nize the principles which are to be applied. Whatever he does must stand the test of time and service.

Success in engineering depends upon many qualities which are essential to success in any pursuit; such as pluck, perseverence, common sense, firmness, and good judgment. Special qualifications are facility in mathematics and an interest in the processes and results of some branch of engineering beyond the natural boyish love for the construction of boats and mechanical contrivances. There must be a fixt purpose which is kept steadfastly in mind, some definite thing to be done toward which end all energies are to be bent. This requires will power, concentration. Too many students entering college are decidedly lacking in this respect. They do not realize that their success in life will depend upon their own efforts, that they must work long and hard to accomplish anything really worth while. Knowledge is not a matter of blind substitution in formulas, nor can it be acquired by absorption as a sponge absorbs water. The instructors are but drill masters who seek to instil into the student certain principles, so that when the real work of his life is before him, he will have the ability to analyze his problems and to apply the correct principles to each case.

There are certain maxims which every young engineer should keep in mind. An old Persian proverb says that one pound of learning requires ten pounds of common sense to apply it. While it is very well for every young man to be ambitious and to have high ideals, he must not chafe unduly at the restraints placed about him. Look well for opportunity and when it comes take advantage of it fully. But to attempt to reach the top of the ladder at a single leap is dangerous. Experience is a vital factor in engineering and the upper rounds of the ladder can only be held, after attainment, by those who have climbed the rounds below and observed carefully while climbing.

An old California ship builder has given the following characteristic idea about mesuring men:

"A man is like a ship, supported by his own displacement. When launched into the world he finds no empty place ready to receive him. No one scoops out a hole in the water to receive the ship: when launched she must displace her weight of the element into which she plunges. We measure a ship by its displacement; that is, the amount of water it puts out of the way in making room for itself. If a ship has twenty thousand tons displacement, that indicates the size of the ship. What is the displacement of each one of us? Everyone shows in his face and bearing the measure of his displacement."

Before discussing the various fields or branches of engineering, let us look for a moment at the trade school and distinguish between it and the engineering college. It is the purpose of the trade school to develop along certain more or less narrow lines; to fit the boy as soon as possible for a subordinate shop or trade position. The boy who takes one of these courses does so because he knows that his earning power is temporarily increased. In these courses only the elementary subjects are taught, such as have a direct bearing on the particular trade to be learned. The broader training and larger outlook is not and cannot be given, for the purpose is not to make a man capable of taking the lead, but merely to make a skilled workman. Those who are to be leaders—foremen, superintendents or managers—must have the true engineering training and it will be comparatively easy for them to specialize should they wish to do so. An engineer may or may not be a skilled artisan, but he must have a broad vision and an ability to plan, for it is necessary that he keep in mind the finished product and make each step be according to a prearranged, logical plan. While he may not be able to fashion the various parts himself, he must have a thoro knowledge of the possibilities of the various crafts he wishes to utilize, in order that his design may be built as cheaply as possible and accomplish the desired purpose.

Briefly, the distinction is that between an occupation and a profession. A profession properly involves a liberal education and mental rather than manual labor. The trade school teaches an occupation, a trade, as it is commonly called, while the engineering college teaches a profession—something higher, better, broader.

The fields of engineering are so varied and subdivided that to give a good general idea of the work of each would involve in many instances a cataloging of the individual phases of work. Due to the development of engineering and to the conditions surrounding the engineer in the commercial world, there is a widespread tendency toward greater and greater specialization. As a result, we have, in addition to the five great divisions of civil, mechanical, electrical, mining, and military engineering, such subdivisions as sanitary, architectural, chemical, structural, hydraulic, railway, refrigeration, municipal, illuminating, marine, and highway engineering.

It is utterly impossible for an engineering school to follow such subdivisions, and it would be extremely inadvisable to do so if it were possible, so that the tendency in the educational field is toward a greater simplification and a more general course which shall lay a broad foundation upon which the young engineer can build during his apprenticeship in the branch he chooses to follow after graduation.

No discussion of military engineering will be presented, altho in point of time it was the first of all the engineering branches. The military engineer of today is trained to use the knowledge of the other branches of engineering and as a result we have engineers of the army and navy serving on the board of engineers for the Alaskan railways, building the Panama Canal, and assisting in the construction of coast protection and harbor works. Their work is splendid and worthy of the highest praise, but it is the application of engineering principles other than those of military engineering.

Tredgold's oft-quoted definition of civil engineering is that it is "the art of directing the great sources of power in nature for the use and convenience of man." Civil engineering has been greatly subdivided in recent years until now we have but a correlated group of subdivisions, which taken together may be called civil engineering. The principal subdivisions are railroad construction; hydraulic developments, including the improvement of rivers and harbors and the construction of canals, lighthouses, and dams; structural work, bridges, and buildings in steel and concrete; surveying and geodesy; sanitation, water supply and sewerage. A civil engineer is largely a constructor, with a splendid opportunity to become an administrator. A number of our railroad presidents began their careers as instrument men in a surveying crew, and it is now generally recognized that a man with a technical training and executive ability is the best type of man to direct the great industrial enterprises.

Sanitation received its great impetus with the introduction of the science of bacteriology and the discovery of the tremendous activity of the bacteria and their influence upon the health of the human race. The prevention of disease by the elimination of the conditions favorable to the propagation of disease-producing bacteria, the provision of pure water and the proper treatment of sewage so that it will not contaminate the stream into which it is discharged, are the chief problems before the sanitary engineer. His is a humanitarian work, for upon him, in cooperation with the physician and bacteriologist, will depend the health of communities and nations.

The following statement is from the pen of Mansfield Merriman, himself an able sanitary engineer:

> "The field of sanitary science is a wide one. It includes the collection of vital statistics, and particularly the statistics of mortality and disease, the isolation and quarantine of infectious disease, the disinfection of houses, and the proper burial of the dead. It treats of the methods of heating and ventilating public buildings so as to promote comfort and health, of the methods

for securing pure and abundant supplies of water, of the drainage of land, and of the removal of garbage and sewage. It invokes the science of the biologist and chemist, the experience of the physician, the constructive talent of the engineer, and the authority of the legislature in order to preserve and protect the health of the community."

The municipal engineer must be able to handle the varied engineering problems that arise in a modern city. There are certain lines of work in which he should be an authority; namely, the location of property lines, building construction and proper building codes, the layouts of streets and street improvements, the design of sewer systems, the purification of water and the proper treatment of sewage. If the city wishes to carry out an improvement requiring special experience, a specialist in this work should be consulted and his advice followed. In the larger cities the city engineer's office has special departments to handle special problems, and the man at the head of such a department should have wide experience in his work. The opportunities for municipal engineers have been greatly increased by the recent movement in favor of a city manager for our cities, as it is the engineer who is called upon as best qualified to fill the position.

The mechanical engineer has to do with the design, manufacture, sale, erection and operation of an enormous variety of machinery. Here also we have a specialization into steam engineering, gas engineering, compressed air and refrigeration engineering, automobile engineering, aviation and heating and ventilating engineering. We have the production of machines for various industries, the design of power plants, and the complete layout of industrial plants for the production of articles of commerce. In this day of high efficiency, both of men and machines, the mechanical engineer is the one who is called upon to cheapen the cost of production by a critical study of the way the material is handled in the plant and also by designing improved machinery. In many cases the operations of the machines are automatic so that one attendant can look after a number and he need not be a skilled mechanic. One of the recent inventions is casting under pressure in steel dies, so that the castings have the exact shape and dimensions required and need no finishing, as every part is smooth and perfectly formed when the casting is removed from the die.

In the sales departments of machine companies, it has been recognized that the man who best understands the machines he is selling will make the best salesman. So there has been developed a type of

engineer salesman, a man with a technical training, together with a thoro knowledge of the machinery he is to sell and a special training in the art of salesmanship.

Electrical engineering is a comparatively young branch but a very vigorous one. The greater part of its progress has been made within the past quarter century and the rapidity of the advance bids fair to continue. Its influence upon the other branches of engineering has been most marked: it has furnished the mechanical engineer with more rapid, more precise, and more easily controlled tools; for the mining engineer, it has provided electric mining machinery, electric hoists and haulage, electric furnaces, and, especially in the west, has brought in cheap power from the waterfalls. So great is its influence that it has been well said that no one can be a successful engineer in any field without possessing the rudiments of electrical engineering.

In its field are the design and operation of power plants for the production of electricity, street railways, interurban railways, electrical machinery, the electrification of steam railways, electric drives for machinery, electric lighting and transmission of power, electric smelting, the telegraph, telephone, and wireless telegraphy. The great flexibility and efficiency of an electrical installation have been perhaps the greatest factors in the tremendous development that has taken place.

While mines and quarries were operated centuries ago, the real development of mining began comparatively a few years ago. We ordinarily associate the work of the mining engineer with coal and metal production, but while this covers the greater part of the field there are many other commercial products brought forth under his direction. In coal mining the work of the mining engineer ceases when the product has been brought to the surface, but in metal mining there are two distinct lines which may be chosen. One deals with the mining or production of the mineral, while the other deals with the treatment of the ore after it has been brought to the surface. In the mine, the principal problems are tunneling, timbering, cutting, blasting and removal of material or ore, irregular geological conditions, and proper ventilation. At the surface we have the construction of headworks, hoisting apparatus, material storage, and shafts, and both above and below innumerable provisions for the safety of the workers. Ore veins vary from a few inches in thickness or even discontinuous bodies, to vast deposits, as in the Minnesota iron region, so that the methods to be employed vary widely. The engineering problems involved in the recovery of metals from their ores are very complex and demand a thoro knowledge of metallurgical chemistry

and some mechanical engineering. But the field of the mining engineer is not restricted to mining. In the construction of tunnels and the blasting of rock he is best qualified to direct and while this work is often classed as a part of civil engineering, we find that in most of the work of this character the responsible positions are filled by mining engineers.

The conquest of the world, either political or commercial, demanded the use of ships. The twofold nature of this demand gave rise to a two-fold development in shipbuilding which exists even today; namely, ships of war and ships of commerce.. Commercial vessels are designed for a given purpose and will not serve any other advantageously. An ocean greyhound would be a poor freighter and vice versa. There are various problems to consider, such as the shape of the hull, the ease with which the ship cuts the water, smoothness in rough waters, vibration of the propelling machinery, speed, and interior arrangements. We have the two divisions of naval architect and marine engineer; the one dealing with problems of hull construction and interior arrangement, the other with the adaptation of the driving power to the vessel. So the marine engineer is in reality a mechanical engineer with a special field and a close association with the naval architect.

Engineering today has reached the stage where we cannot say that here ends the work of one branch and here begins that of another. All are so closely interwoven that while we can point out the broad general fields, the border regions are vague and undefined. We pass from one field to another almost without being aware of it; each makes use of many principles of the others and is in turn modified by the assimilation. Certain branches permeate others and form indispensible portions of them: as chemical engineering, for instance, is vital to the existence of practically every form of engineering activity. While it has been possible to discuss briefly and incompletely but a few of the phases of engineering, the breadth and depth to which it has grown are readily seen. But not by its own efforts alone has it achieved this position: for, working quietly and unostentatiously, men of science, not engineers, have frequently enunciated principles and laws in accordance with which the engineer later built his machine or structure. Yet with all this rich heritage, the achievements of the past and the results obtained by scientific investigators, the engineer must be a man with a vision, a great inspiration, who does things not because of an expected reward, but because of the joy in beholding a work well done, a work that shall be a service to others and an uplift to humanity.

Notes on Optical Pyrometry

Bartholomew John Spence,

Assistant Professor of Physics, University of North Dakota

THE following article contains a brief sketch of a modified Glan spectro-photometer used as an optical pyrometer for the determination of temperatures greater than 1100° C. and also a general method for the calibration of such pyrometers by means of one or more known temperatures.

The Glan spectro-photometer is essentially a spectrometer with suitable modifications for the comparison of the intensities of two identical wave-length intervals produced by the spectra of two different sources of light. For clearness sake, a brief description of the mechanism of this type of spectro-photometer will be given. In the accompanying figure S is a divided slit before the upper half of which is placed a totally reflecting prism by means of which the luminous intensity of a lateral source of illumination is focused upon the slit. Light from the source of illumination to be studied is focused upon the lower half of the slit. The two beams of light thus entering the collimator tube are rendered parellel by means of the objective lens O. Placed before the objective lens of the collimator is a double image prism D which divides each beam of light into two beams polarized at right angles to each other, thus making in all four beams of light. The double image prism is so oriented that the four images of the slit as seen in the eye-piece of the telescope will form a vertical line. The two extreme images are of no use and are usually cut out by means of a suitable diaphram placed in the eye-piece. The remaining two adjacent images are polarized at right angles to each other and each corresponds to a source of light.

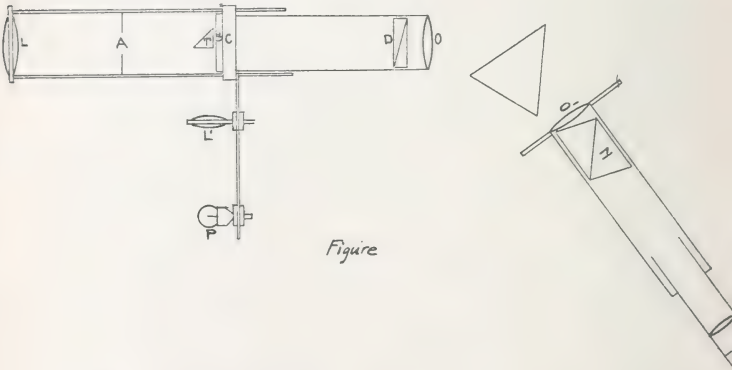
The two beams then pass thru a 60° glass prism and are broken up into two adjacent spectra one above the other. These two spectra enter the objective lens O′ of the telescope and finally pass thru a Nicol prism N on to the eye-piece of the telescope. Attached to the Nicol prism is a divided circle, in such a manner that the combination may be rotated about an axis parallel to the telescope of the instrument. In the eye-piece is inserted a suitable diaphram which allows any desired spectral interval to be viewed for the purpose of comparison.

The function of the Nicol prism combination when set at any position whatsoever is to allow a componet of each spectral interval to be transmitted parallel to the plane of maximum transmission of

the Nicol prism and thus observed in the eye-piece. Obviously there is a position of the Nicol prism for which equal components of the light from each source of illumination will be transmitted. This then constitutes a photometric balance and the equation of balance may be readily shown to be

$$\frac{I}{I'} = \tan^2\theta$$

where I is the intensity of the unknown source of light and I′ is the intensity of the known source and is usually regarded as unity. The angle θ is the angle thru which the Nicol prism must be rotated to bring about a photometric balance.



Figure

The modification of this form of spectro-photometer for the determination of temperature consists in fitting the collimator with an auxilliary lens L with which to focus the unknown source of light upon the upper half of the slit. The manner in which this is done is to fit the collimator with a collar C (figure) containing two sliding rods projecting away from the slit and parallel to the collimator. These rods carry the auxilliary short focus lens L, and also a circular aperture A the plane of which is parallel to the plane of the slit and so designed that it may slide on the rods and remain at a fixt distance from the slit when focusing the source of intensity upon the slit.

Projecting in a lateral direction from the collimator is a rod carrying a small electric lamp P and a small lens L′ of short focus to bring the image of the lamp filament upon the upper half of the slit by means of the totally reflecting prism T. This is in brief

the modification necessary to convert the Glan spectro-photometer into a pyrometer.

This form of pyrometer may be calibrated to determine unknown temperatures by three distinct methods. The first is a point by point or empirical method of which little need be said. It consists simply in obtaining a series of photometric balances at a number of different temperatures thruout the range for which the instrument is to be used. Of course the source of radiation for the calibration must be the black-body and the standard electric lamp must radiate at a know constant current. This is true for all methods of calibration.

The second method is a two-point calibration. That is, it requires a knowledge of only two temperatures and their corresponding angles for photometric balance, and necessitates the use of the Wien equation.

$$\log I = \log \tan^2 \theta = K_1 - K_2 \frac{1}{T}$$

The constants K_1 and K_2 are determined by means of the knowledge of the two angles for photometric balance and their corresponding temperatures. This is a favorite method for the calibration of such an instrument and is well known.

The third method is a one-point calibration and requires for a complete calibration the knowledge of only one angle for photometric balance and the temperature of the black-body source giving rise to the balance. There are two ways in which such a calibration may be attained. The one necessitating a graphical calibration has been worked out by Shook. (Physical Review, pg. 342, 1910.) The method is somewhat cumbersome and requires a graph for all temperature determinations. The other method free from the use of a graph and perhaps somewhat more simple involves the use of Wien's law as does the method of Shook. The method avoiding the use of the graphical method of solution for the determination of temperatures will be outlined in what follows.

Let us assume that the instrument is to be used for the determination of temperatures not very far removed from 1300° C. The Nicol prism is then set so that the angle θ is 45°. The radiation from a black body radiating at some known temperature not far from 1300° C. is focused upon the lower half of the slit of the instrument. The standard light is adjusted until a photometric balance against the black-body radiator is obtained. The current thru the standard lamp is carefully noted and always set at this particular

value for all future temperature determinations. The instrument is now completely calibrated.

To determine an unknown temperature it is only necessary to obtain a photometric balance for the source radiating at that temperature at the particular wave-length for which the instrument has been calibrated. Wien's law is then applied in the following manner. Substitute the value of the calibration temperature and the value of log $\tan^2 45°$ in Wien's equation and we have

$$0 = K_1 - \frac{C_2 \log \theta}{LT}$$

where L is the wave-length, T is the calibration temperature, C_2 is a constant equal to 14500 and K_1 is a constant which is to be eliminated. Substituting the value of the angle obtained in the photometric balance against the source whose temperature is sought again in the Wien equation and we have

$$\log \tan^2 \theta = K_1 - \frac{C_2 \log \theta}{LT_x}$$

in which T_x and θ are respectively the unknown temperature and the corresponding angles for photometric balance. The elimination of K_1 from these two equations gives finally

$$\frac{1}{T_x} = \frac{1}{T} - \frac{L \log \tan^2 \theta}{C_2 \log e}$$

as the equation from which the unknown temperature may be determined in terms of the constants of the Wien equation.

As an illustration of the method of calibration the Table has been inserted. It contains a series of temperature determinations of the temperature of a platinum wedge-shaped cavity (Mendenhall, Astro-physical Journal, 33, 91, 1911) heated electrically. The temperature of the wedge was determined by means of an Holborn-Kurlbaum optical pyrometer. The temperature used for the calibration was 1515° A. The table contains three series of determinations for three different wave length intervals.

The agreement of the temperatures obtained with the modified spectro-photometer with those obtained with the Holborn-Kurlbaum pyrometer are seen to be good. The deviation of the temperature mesurements are greater as the range of the mesurements is extended. This is to be expected however since the sensibility of the Nicol prism combination for obtaining photometric balance decreases as the angle deviates from the value 45°.

The precision of the instrument is of about the same order as that obtained with the Wanner optical pyrometer to which it is

similar in many respects. It has not the precision of the Holborn-Kurlbaum pyrometer owing to the greater complexity of the optical system.

TABLE I

T_x° A. observed	$1/T_x$	θ degrees observed	$1/T_x$ computed	T_x° A. computed	Difference
1323	.0007559	15.0	.0007454	1324	+1
1403	.0007128	26.0	.0007124	1403	0
1488	.0006720	40.5	.0006723	1487	−1
1515	.0006600	45.0	.0006600	1515	0
1583	.0006317	54.5	.0006413	1584	+1
1668	.0005997	67.0	.0006005	1665	−3
1810	.0005525	777.5	.0005536	1805	−5
1323	.0007559	19.0	.0007374	1326	+3
1403	.0007128	26.5	.0007166	1395	−3
1488	.0006720	40.5	.0006728	1485	−3
1515	.0006600	45.0	.0006600	1515	0
1583	.0006317	54.5	.0006325	1581	−2
1668	.0005997	65.5	.0005961	1675	+7
1810	.0005525	75.5	.0005529	1808	−2
1323	.0007559	20.0	.0007562	1322	−1
1403	.0007128	30.0	.0007126	1403	0
1488	.0006720	41.5	.0006718	1488	0
1515	.0006600	45.0	.0006600	1515	0
1583	.0006317	53.0	.0006223	1581	−2
1668	.0005997	61.5	.0006000	1664	−4
1810	.0005525	71.0	.0005556	1800	−10

$L = .52u$

$K_2 = 12110.3$

$$\frac{I}{T_x} = \frac{I}{T} - \frac{\log \tan^2 \theta}{12110.3}$$

$L = .59u$

$K_2 = 10673.4$

$$\frac{I}{T_x} = \frac{I}{T} - \frac{\log \tan^2 \theta}{10673.4}$$

$L = .71u$

$K_2 = 8869.5$

$$\frac{I}{T_x} = \frac{I}{T} - \frac{\log \tan^2 \theta}{8869.5}$$

A Study of Riemann's Surfaces

Raymond Royce Hitchcock,

Associate Professor of Mathematics, University of North Dakota

The construction of a Riemann's surface for a multiform function

RIEMANN has devised a method of treating an algebraic equation in its entirety and yet as if it were a uniform function, a method of following the continuous variation of a function.

If we have given an n—valued function such as $w = \sqrt[n]{z}$, instead of following simultaneously the variation of the n branches as z moves in one place, we may conceive n separate planes superposed on the z— plane, one for each branch of the function, and take the n leaves together to form the region for the variation of the variable w. To a point in each sheet corresponds only a single value of the function and to the n points lying one immediately below the other in all the n sheets correspond the n different values of the function which belong to the same z. To secure connection between the planes each of them is supposed to be slit along the w-axis, the axis of reals, from 0 to ∞, and the n planes are joined together so that the upper edge of the slit in the first sheet is joined to the lower edge of the slit in the second sheet; the upper edge of the slit in the second sheet to the lower edge of the third, and so on, this last junction taking place across the two intervening now continuous leaves. The whole of the z-plane is thus clothed with an n-leaved, continuous, flat, staircase-like surface, and continuous path on which must, if it circulates about $z = 0$ or $z = \infty$, do so n times before it can return to itself. This surface is called the "Riemann's Surface" for $w = \sqrt[n]{z}$.

The origin about which the surface winds n times before returning into itself is called a *winding-point* of the $(n - 1)$th order. The value $z = 0$ is said to be a branch-point of the $(n - 1)$th order for $w(z)$. At these branch-points, then, where several function values, elsewhere different, become equal to each other, several of these sheets are connected so that the particular winding-point is supposed to lie at the same time in the sheets which it connects but counts but once as a point of these sheets. The number of sheets thus connected at a branch-point can be different at each branch point and is equal to the number of functional values which change into

one another in cyclical order for a circuit of the variable around the branch-point.

The complex variable may describe very different paths in passing from an initial point z_0 to another point z_1, on the z— plane. The question arises,—can the path described affect the terminal value w_1 of w, on the Riemann surface when w starts with a definite value w_0 corresponding to z_0? If so, the curves desribed by w corresponding to different paths between z_0 and z_1, tho starting from a common initial point may end in different points. For uniform functions the final value of w_1 must be independent of the path taken, and this is apparent since the Riemann surface is in this case a plane. A multiform function, however, has several values for the same value of z and hence there exists the possibility that different paths from z_0 to z_1, may lead to different values of the function, and therefore to points in different sheets of the Riemann surface. For instance, consider $w = \sqrt{z}$. Let z pass from 1 to 4 by different paths. If we start with $w = +1$ corresponding to $z = 1$, then it is possible that some of the paths shall lead from $w = +1$ to $w = +2$, and others from $w = +1$ to $w = -2$. Put $z = r\,(\cos\phi + i \sin\phi)$. Then $w = \sqrt{r}\,\left(\cos\frac{\phi}{2} + i \sin\frac{\phi}{2}\right)$ where $\sqrt{r}$ is the modulus of w. Start with $w = +1$, then $r = 1$ and $\phi = 0$. If z describes the path 1 to 4, which does not enclose the origin, ϕ returns to its initial value and hence w receives the value $+2$. Let z describe the path 1 to 4 going once around the origin; then ϕ becomes equal to 2π and $w = -2$.

It is now necessary to study those points at which two or more values of the function w, in general different, become equal to one another.

Multiple or equal roots of an equation of the n-th degree are found in this way:

If r be k times a root of $f(x) = 0$, then $x - r$ is k times a factor of $f(x)$ or $(x - r)^k$ is a factor.

Therefore $f(x) + (x-r)^k F(x)$, where $F(x)$ stands for the product of the remaining factors of $f(x)$, and does not contain $x - r$. The differentiation of both sides of this equation with respect to x gives us

$$f'(x) = k\,(x - r)^{k-1} F(x) + (x - r)^k F'(x),$$

the highest common factor of which is $(x - r)^{k-1}$. We can differentiate again and find the H.C.F. of this last H.C.F. which will be $(x - r)^{k-2}$. Since k is a finite number this operation may be contin-

ued until the exponent of $(x - r)$ is 1. We find therefore the root r by putting the last H.C.F. equal to 0. This process gives no trouble unless there are more than two multiple roots occurring the same number of times.

Consider next the function

$$w^3 - w + z = 0$$

Cardan's formula gives for the three roots of this equation $w_1 = p + q$, $w_2 = a\,p + a^2\,q$, and $w_3 = a^2\,p + a\,q$ where $p = [\tfrac{1}{2}(-z - \sqrt{z^2 - \tfrac{4}{27}})]^{\frac{1}{3}}$, $q = [\tfrac{1}{2}(-z + \sqrt{z^2 - \tfrac{4}{27}})]^{\frac{1}{3}}$, and a, a^2 are the two imaginary square roots of unity, i. e.,

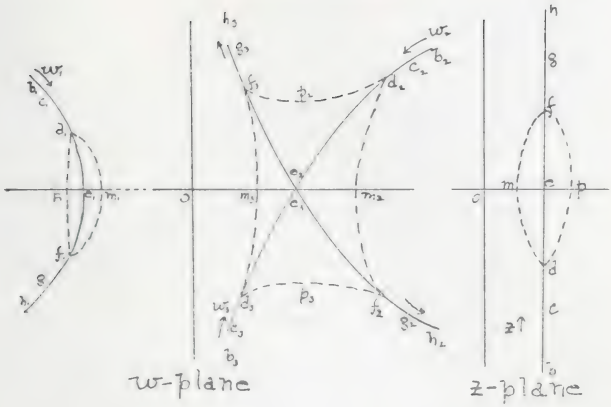
$$a = \frac{-1 + i\sqrt{3}}{2}, \qquad a^2 = \frac{-1 - i\sqrt{3}}{2}$$

For each value of z, w has in general the three values w_1, w_2, w_3. The last two of these are equal when $p = q$, that is when $z = \pm \frac{2}{\sqrt{27}}$. At this point $w_2 = w_3 = \sqrt{\tfrac{1}{3}}$. If the variable z changes continuously, describing a definite path, then w_1, w_2, w_3 change continuously and the three corresponding points describe three separate paths. When z passes thru the point $z = +\frac{2}{\sqrt{27}}$ both w_2 and w_3 assume the value $\sqrt{\tfrac{1}{3}}$ and hence their paths meet in that point. At the passage thru this point, therefore, w_2 can go over into w_3 and w_3 into w_2 without interruption of continuity. It remains entirely arbitrary on which of the two lines each of the quantities w_2 and w_3 shall continue its course. In this place a branching of the lines described by the quantities w_2 and w_3 takes place and Riemann has called such points ***branch-points***.

A point a, at which either a discontinuity occurs or several functional values become equal, is to be called a branch-point when, and only when, the function changes its value for every sufficiently small circuit about the point. It is not necessary for all the functional values to change.

In the accompanying figure the three paths for w_1, w_2, w_3, respectively, are drawn for the case when z describes a straight line parallel to the y-axis and passes thru the branch-point $e = \frac{2}{\sqrt{27}}$.

We shall study next the permutations in the branches of a function $w = f(z)$. z describes a closed line around a single branch point. At z_0 the function has n values which may be written in a



certain sequence. After the variable has described the closed line and returned again to z_0, each of the n functional values will have passed either into another or remained unchanged. The variable z is again at z_0, and therefore these new values of the function cannot differ from the former in their totality but if we suppose them to be written in the sequence in which they have arisen in succession from the former, they will occur in an arrangement different from the previous one.

We will show that any one arrangement of n elements, however, can be derived from another by a series of cyclical permutations.

By a cyclical permutation of the p^{th} order is to be understood one in which p elements are so involved that in the place of the first of these we put a second, in the place of the second, a third, etc., and finally in the place of the p^{th} the first. After p repetitions of the permutation and not sooner, the original arrangement is restored. Each element thus reappears in its original place only after all the $p-1$ other elements have occupied the same place.

Suppose the elements

1 2 3 4 5 6 7 8 9 10 11

have passed into the arrangement

3 11 5 2 7 10 1 9 6 8 4.

It is evident that the row

1 3 5 7

has changed into

3 5 7 1;

these elements therefore form a cyclical permutation of the fourth order, which we denote by (1 3 5 7).

If we next proceed from 2, it is evident that the row 2 11 4 changes into 11 4 2; a cyclical permutation (2 11 4) of the third order. The next element not yet employed is 6. Then the

row 6 10 8 9

changes into 10 8 9 6,

and we have a third cyclical permutation, (6 10 8 9), of the fourth order. The eleven elements are now exhausted and the second given arrangement is derived from the first by the three cyclical permutations above, (1 3 5 7), (2 11 4), (6 10 8 9).

Whatever arrangement of functional values we have after the variable has made a circuit about the branch-point, it can be produced by a series of cyclical permutations of the functional values. The values of the function are divided at each branch-point into a series of cycles so that in each cycle only certain definite values of the function can permute among themselves, with the total exclusion of all values contained in another cycle.

If now the z — surface be supposed to consist of n sheets, the preceding discussion necessitates that the sheets shall be so connected along branch cuts that the cyclical interchanges of leaves around each winding-point exactly correspond to the cyclical permutation of the branches of the function around the corresponding branch-points.

In the case of the last function studied, $w^3 - w + z = 0$, the branch-points are $z = \pm \frac{2}{\sqrt{27}}$ and $z = \infty$. The permutations are,—

along the branch cut $+ \frac{2}{\sqrt{27}}$ to ∞, (1) (3 2),

" " " " $- \frac{2}{\sqrt{27}}$ to ∞, (1 3) (2)

A circuit about both $+ \frac{2}{\sqrt{27}}$ and $- \frac{2}{\sqrt{27}}$ which is equivalent to a circuit around $z = \infty$ gives the cyclical permutations (1 3 2).

Let us illustrate the preceding considerations by further examples and show how the functional values pass into one another on describing closed lines around a branch-point.

Problem I.

$$w = \left[\frac{z - a}{z - b}\right]^{\frac{1}{3}} + [z - c]^{\frac{1}{2}}$$

This function is the root of the equation of the sixth degree, $(z - b)^2\, w^6 - 3\,(z - b)^2\,(z - c)\, w^4 - 2\,(z - a)\,(z - b)\, w^3 + 3\,(z - b)^2\,(z - c)^2\, w^2 - 6\,(z - a)\,(z - b)\,(z - c)\, w + (z - a)^2 - (z - b)^2\,(z - c)^3 = 0$.
it has six leaves and the branch-points a, b, c, and ∞. Put $\sqrt[3]{z - a} = t$, $\sqrt[3]{z - b} = u$, $\sqrt{z - c} = v$ and make

$$\cos\frac{2\pi}{3} + i n \sin\frac{2\pi}{3} = \frac{-1 + i\sqrt{3}}{2} = \alpha.$$

We can write the six functional values thus,—

$$w_1 = \frac{t}{u} + v, \qquad w_4 = \frac{t}{u} - v,$$

$$w_2 = \alpha\,\frac{t}{u} + v, \qquad w_5 = \alpha\,\frac{t}{u} - v,$$

$$w_3 = \alpha^2\,\frac{t}{u} + v, \qquad w_6 = \alpha^2\,\frac{t}{u} - v,$$

Let us consider circuits of the variable around the point a; t passes into αt, $\alpha^2 t$, t, ------, while u and v remain unchanged. Therefore the permutations are (1 2 3) (4 5 6).

For circuits around the point b, t and v remain unchanged, and u changes into αu, $\alpha^2 u$, u, ------and the permutations are (1 3 2), (4 6 5).

For circuits around the point c, t and u are unchanged and v changes into $-v$, $+v$, ----------. The permutations are (1 4) (2 5) (3 6).

If z describes a closed line including two branch-points, we can replace such a one by two successive circuits, each around one point. A circuit about the three branch-points, a, b, and c gives us the cyclical permutation about the branch-point ∞ which is (1 4) (2 5) (3 6).

The Riemann surface for the representation of the above six-valued function w must be a singly-connected surface of six sheets superposed on the z-plane. Around each of the branch-points a and b, w_1, w_2, w_3, on the one hand and w_4, w_5, w_6 on the other, permute cyclically. Hence to connect the leaves properly we made a like cut in each of the six leaves from a to b and along these cuts we connect the first three sheets cyclically and also the last three sheets. Around the point c, however, w_1 changes to w_4, w_2 to w_5 and w_3 to w_6. The solution shows that at the point $z = \infty$ the sheets are connected in the same manner as at the point c. Hence we also make a second cut in each of the six leaves from c to ∞ and along these cuts we connect cyclically sheets 1 and 4, 2 and 5, and 3 and 6.

These cuts are arbitrary except that no one shall intersect itself and no two cuts shall intersect one another.

Problem II.

$$w = \sqrt{z - a} + \sqrt{z - b} + \sqrt{z - c}$$

There are eight branches which we designate according to sign as follows:

w_1	+	+	+	w_5	−	+	+
w_2	−	−	−	w_6	+	−	−
w_3	+	−	+	w_7	−	−	+
w_4	−	+	−	w_8	+	+	−

Let $z - a = r\,(\cos\phi + i \sin\phi)$. Then the initial value of w is,

$$w_1 = r^{\frac{1}{2}}\,(\cos\frac{\phi}{2} + i \sin\frac{\phi}{2}) + \sqrt{a - b + r\,(\cos\phi + i \sin\phi)} + \sqrt{a - c + r\,(\cos\phi + i \sin\phi)}.$$

Rotate z around a so that ϕ is increased to $\phi + 2\pi$. Then $w_2 =$

$$r^{\frac{1}{2}}\,(\cos\,[\frac{\phi}{2} + \pi] + i \sin\,[\frac{\phi}{2} + \pi]) + \sqrt{a - b + r\,(\cos\phi + i \sin\phi)} + \sqrt{a - c + r\,(\cos\phi + i \sin\phi)}.$$

Now $\cos\,[\frac{\phi}{2} + \pi] + i \sin\,[\frac{\phi}{2} + \pi] = (\cos\frac{\phi}{2} + i \sin\frac{\phi}{2})\,(\cos\pi + i \sin\pi)$

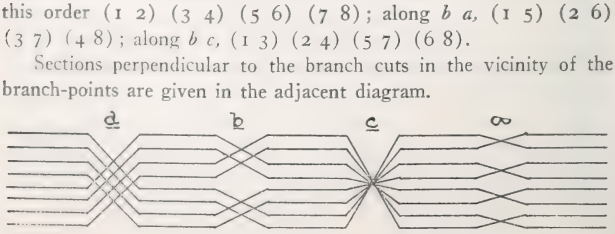
and $(\cos\pi + i \sin\pi) = -1$.

Therefore w_1 has changed to w_2 which equals $-w_1$.
Another rotation about a of 2π brings w back to its first value.
Rotations about b and c can be treated in like manner.
The permutations are then,

about a	(1 5) (2 6) (3 7) (4 8)
about b	(1 3) (2 4) (5 7) (6 8)
about c	(1 8) (2 7) (3 6) (4 5)
about ∞	(1 2) (3 4) (5 6) (7 8)

To construct this Riemann's surface lay eight sheets on the plane and mark the four branch-points a, b, c, and ∞. Now make branch-cuts from b to ∞, a, and c. The sheets along $b\ \infty$ are connected in this order (1 2) (3 4) (5 6) (7 8); along $b\ a$, (1 5) (2 6) (3 7) (4 8); along $b\ c$, (1 3) (2 4) (5 7) (6 8).

Sections perpendicular to the branch cuts in the vicinity of the branch-points are given in the adjacent diagram.



Problem III.

$$w = \left[\frac{z - a}{z - b}\right]^{1/2} + \left[\frac{z - c}{z - d}\right]^{1/3}$$

There are six leaves and four branch-points, a, b, c, and d. The possible changes of functional values are

w_1	$+$ $+$	w_4	$-$ a
w_2	$-$ $+$	w_5	$+$ a^2
w_3	$+$ a	w_6	$-$ a^2

Put $z - a = r\,(\cos\phi + i \sin\phi)$.

The initial value of w is

$$w = \frac{r^{1/2}\,(\cos\frac{\phi}{2} + i \sin\frac{\phi}{2})}{[a - b + r\,(\cos\phi + i \sin\phi]^{1/2}} + \frac{[a - c + r\,(\cos\phi + i \sin\phi)]^{1/3}}{[a - a + a\,(\cos\phi + i \sin\phi]^{1/3}}$$

Rotate z about a in the positive direction so as to make ϕ increase to $\phi + 2\pi$. Then $w_2 =$

$$\frac{r^{1/2}\,[\cos(\frac{\phi}{2} + \pi) + i \sin(\frac{\phi}{2} + \pi)]}{[a - b + r\,(\cos\phi + i \sin\phi)]^{1/2}} + \frac{[a - c + r\,(\cos\phi + i \sin\phi]^{1/3}}{[a - b + r\,(\cos\phi + i \sin\phi]^{1/3}}$$

We see then that w_1 in changing to w_2 has become equal to $-w_1$. Another rotation thru an angle of 2π brings w back to the initial value.

Now let us rotate z about b which is done by making a change only in the denominator of the first fraction. We find again that w_1 changes to $-w_1$.

A rotation about c changes in similar way w_1 into $w_2 = a\,w_1$. A second rotation changes w_2 to w_3 where $w_3 = a\,w_2 = a^2\,w_1$, and a third rotation gives $w_4 = a\,w_3 = a^3\,w_1 = w_1$.

Rotation about d changes

w_1 into $w_2 = \dfrac{w_1}{a} = a^2\,w_1$,

w_2 into $w_3 = \dfrac{w_2}{a} = \dfrac{w_1}{a} = w_1$, and

w_3 into $w_4 = \dfrac{w_3}{a} = \dfrac{w_2}{a^2} = \dfrac{w_1}{a^3} = w_1$.

To sum up, the cyclical permutations of the function are,—

about a,	$(w_1\ w_2)\ (w_3\ w_4)\ (w_5\ w_6)$
about b,	$(w_1\ w_2)\ (w_3\ w_4)\ (w_5\ w_6)$
about c,	$(w_1\ w_3\ w_5)\ (w_2\ w_4\ w_6)$
about d,	$(w_1\ w_5\ w_3)\ (w_2\ w_6\ w_4)$

The Riemann's surface for this function is a six sheeted surface. The branch-points are a, b, c, d, and branch-cuts to be made

are a b and c d. The sheets are to be connected in this manner,—along a b, (1) (2 4) (5 6) ; along c d (1 3 5) (2 4 6).

Sections perpendicular to the branch-cuts in the vicinity of the branch-points are given in the adjacent diagram.

From the preceding considerations we see that, given a multiform function we can pass continuously from one of the values which the function can assume for the same value of the variable to another by assigning complex values to the variable and letting it pass thru a series of continuously successive values, which ends with the same value with which it began.

A definite and continuous series of values of the variable (a definite path) always leads to a definite function value except when the variable leads thru a branch-point, and this case can always be obviated by making an indefinitely small deviation in the circuit in the vicinity of the branch-point.

If the circuits around branch-points can be done away with, the function may be treated as if it were uniform. Our attention is thus confined to a single branch. This can be done by demarcating certain portions of the plane in which the variable z is moving and not permitting z to cross the moundary of such a region. This demarcation, for example, can always be effected by making cuts or slits in the z — plane from each branch-point to ∞.

A Riemann's surface can be constructed for any algebraic function if we can find a system of branch-lines which satisfy these two conditions:

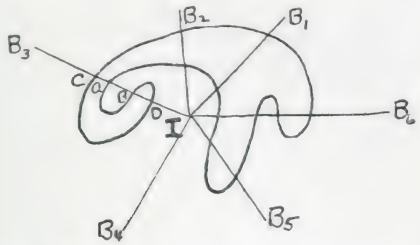
(1) A simple circuit around a branch-point must give proper sequences of change from sheet to sheet; if this is satisfied for each of the branch-points it is satisfied for any path whatever enclosing one or more branch-points.

(2) If the variable describes a circuit that encloses no branch-point it must reassume its initial value in the initial sheet.

In the z plane take a point I. Lay on the z — plane n sheets and mark the branch-points B_1, B_2, B_3 ____, B_n. Draw lines from I to each of the branch-points. These lines must not meet except at I. Cut each of the six sheets from I to the branch-points, and join the sheets in such a way that the first of the above conditions is satisfied. This occurs when the surface has along each of these

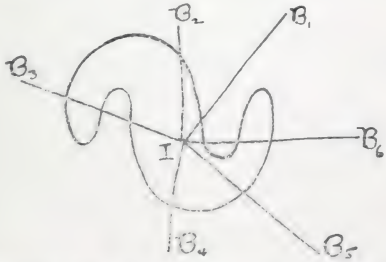
lines the sequence of interchange the same as the order in the cycle of functional values for a small circuit around the branch-point at the extremity of the line.

Now consider a circuit which excludes I and all the branch-points.



This circuit intersects each branch-line an even number of times if it intersects it at all. The crossings at A and B counteract each other as do also the crossings at C and D. The circuit can then be changed so as not to cut I B_1 at all. This change is true with respect to the circuits crossing any branch-line and hence the circuit can be made without effect to meet no branch line. Therefore on its completion it leaves the sheet unchanged. This fact satisfies the second condition.

Now take a circuit which does include I but none of the branch-points.



This circuit meets each branch line an odd number of times and can be changed to meet each branch line but once. The effect produced by a branch-line on the function is the same as a circuit around that branch-point which is an extremity of the line. The effect then of the circuit which crosses each branch-line is the same as that of a circuit enclosing all the branch-points, which effect is to bring the

value of the function back to the initial value. Again the second condition is satisfied.

Therefore, if I have given an algebraic function $f(w, z) = 0$ I can construct for it the appropriate Riemann's surface by finding the branch-points of the function, taking any other point in the z—plane, constructing the branch cuts and joining the sheets in the cyclical permutations which I shall find by allowing the variable to make a closed circuit about each branch-point.

The simplest classes of functions for which a Riemann's surface is useful are algebraic functions, that is, multiform functions of the independent variable defined by an algebraical equation of the form $f(w, z) = 0$ which is of finite degree in w and z. To every pair of values satisfying this equation there corresponds a point in the Riemann's surface, and every point has a pair of values which we may call its coordinates and which satisfy the equation. The Riemann's surface thus serves for a point locus of $f(w, z) = 0$. Let us illustrate this by $w = \sqrt{z}$. The surface is two sheeted with a branch-out from 0 to ∞. Let z be 1, then w is ± 1; let z be 4 and $w = \pm z$. Let us consider these values as coordinates of a point, thus (1, 1), (1, — 1,), (4, 2), (4 — 2) where z is the first coordinate. Then we see that these coordinates are the coordinates of points on the Riemann's surface, the points (1, 1) and (4, 2) lying on the upper sheet and the points (1, — 1), (4, — 2) lying in the lower sheet directly below the first two.

Undiscovered Plants

NORMA E. PFEIFFER,

Instructor in Biology, University of North Dakota

A FEW years ago a missionary in China noted that the corn in cultivation in an arid region was distinctly different from that he was accustomed to see in our United States. Unlike most of our varieties, this corn would withstand drought in a remarkable way, so that the danger from drying winds was practically overcome. On looking up the history of the cultivation of the form, he found that the Chinese had planted it for centuries. The chances are that they had probably happened upon this favorable race, and had developed it.

From the point of view of those countries to which a corn race able to resist drought would be of great economic importance, this was undoubtedly a discovery. In the same way, the maize that the Hopi Indians have cultivated in New Mexico and Arizona was discovered by white men in some extensive work recently done. Whereas in the Chinese corn, the virtue lies chiefly in the early shedding of the pollen grains which sift down in little rifts before the silk elongates, so that drying of the latter is not disastrous, the Indian corn is useful in having a tremendously long main root which may reach down to a water supply. It also has the advantage of being able to germinate at far greater depths than our races and elongating sufficiently to reach the soil surface.

In one way, these plants already long under cultivation by other peoples, may be said to be "discovered," since the use has been relatively restricted and so shut away from wide ranges. Ordinarily, however, the narrower construction is put on the word discovery, implying finding by man. From this angle, undiscovered plants might be briefly considered under three heads, on the basis of the relation of the time of their existence to the present. Those which have existed in the past but are available now only as recorded in geological strata, constitute the first of these classes in point of time. The second division of those already existent but still unknown may be contrasted with the third group—those plants of the future which shall be man-made.

That there are numbers of plants in the first group which would be of great interest to the botanist, cannot be doubted in view of the fossil forms which have come to light in recent years. These have been useful chiefly in establishing relationships and gaining an

idea of the evolution of the plant kingdom. Within the last three decades, by the finding of some primitive seed plants, the gap between plants reproducing by seeds and those reproducing by spores, has been perceptibly narrowed. That such a gap still exists is evidence that some forms once developed have not come to the knowledge of man. Other serious spaces remain yet to be bridged by discoveries among fossils. Since only relatively a small portion of the earth's surface has been worked over intensively, the hope for finding connecting members in a state of preservation is a reasonable one.

The discovery of such plants as these in the first subdivision may be a source of joy to the pure scientist, and may be of great value in developing knowledge. But when of greatest value to pure science, they are seldom of commercial value. Such is not, however, the situation with regard to the discovery in the realm of plants not yet existent. Their development and so discovery not only may broaden knowledge, but may frequently be of great economic importance. Often, as a matter of fact, the latter is a considerable factor in the development of new forms. Such development is, of course, the work of the plant breeder, who may discover new plants by methods of crossing, selection, etc. Obviously, the number of species possible is very great, since there is a wide range of already existing forms, especially in flowering plants, which serve as starting-places for breeding experiments. The limit may be set only by the patience and time available on the part of the investigator. When one considers that in the bulletin of the Royal Botanic Garden of Kew, England, over 425 new garden plants alone are listed for a single year, one may judge the wide opportunities open to the worker. The field here is practically restricted to seed-plants, except for some ferns, a slightly narrower territory than that for forms preserved as fossils.

In contrast to these man-made individuals, which are often only varieties of well-known forms, are the plants already existing under natural conditions. These may be awaiting discovery by man in any region, altho the chances are greater in a relatively unexplored country than in well-known parts. That the larger proportion of forms reported within recent times, comes from newly opened regions, frequently tropical, gives witness to this statement. Since the ambition of many collectors is the discovery of new forms, even genera, the attraction that an untried area would hold is obvious. In addition, there is the spirit of adventure which may act in some cases. That too much adventure may deter exploration in any given region for a time is also evident. Mexico, which is a fertile field for bo-

tanical exploration, has in recent months been abandoned entirely by those in quest of vegetative material. Some parts had previously been very well worked; mainly those easily accessible, where the temperature range is not excessive and the danger of yellow fever not extreme. Once out of this table-land country into less or not at all frequented territory, where the risks taken are much greater, the rewards are more nearly proportional. On one botanical excursion, a week's work by two investigators opened to man's view 23 new species of mosses alone. Such forms, small and insignificant as they frequently are, might be overlooked by the non-expert, who calls to mind only flowering plants, sometimes even only trees, when vegetation is mentioned. Such an one would require, no doubt, a little training before venturing forth to get all possible out of a region. Yet, with such training, the wide range of country botanically unknown to man at present, would certainly reward the collector by yielding forth new representatives in all the large plant classes.

The value of these, as in man-made forms, may be an economic one, in addition to the scientific interest aroused. An example of this may be noted in such a case as a cover-crop recently developed in Sarawok, Borneo, from a leguminous species of plant found native in the region. Frequently, as among the orchids, forms found native are successfully grown in plant-houses, and add greatly to our horticultural display. Other forms, with cultivation, may give truly desirable additions to our economic crops. The discovery of the wild ancestor of wheat in the arid regions of Palestine, within recent years, did not give a form itself desirable as a cereal, but it had the virtue of starting experiments of a scientific nature which may result in a man-made wheat, especially adapted to cultivation in arid country and yet having the worthy qualities of the wheat developed thru the centuries of cultivation.

Exploration of unknown country, fertile as it is, may well be left to the expert who more readily distinguishes between material already well known and that more likely to yield new forms. For the individual, however, who has not the good fortune to have the training, the time, or the means to work in untried country, there is still held out a hope of enriching the lists of flora for regions already known. It is true that frequently a well-populated region, long-developed, would yield no new native forms, altho contributions to our knowledge as to distribution of already known forms would undoubtedly be of scientific value. On the other hand, unless very intensively worked over from the plant side, (and this is particu-

larly true with lower plants), a region may seldom be said to be hopeless.

As an example of these facts, let us consider a region which may be considered as a well-worked one as far as higher plants are concerned. (In practically all regions, there is still room for much work on the lower, less conspicuous plants). Within two years of each other, two forms among vascular plants have been found in the Chicago region in areas which had doubtless been traversed again and again. In both cases, the forms were small, practically covered by higher prairie grasses and other forms. The one plant, a member of the group in which ferns are classified, had previously been known. The other, a small flowering plant, was an entirely new species never before reported, a member of the family Burmanniaceae, closely related to Orchids.

The history of the discovery of the close allies of this little new plant is a most interesting one, illustrative of several points made above. The first forms were found only within the last century, oddly enough in rather inaccessible regions. An Englishman, Mr. Wm. Griffith, published a description of the genus with its first species, in 1845, from material collected in October of 1834 in Tenasserim. He gave it a poetic name when one considers the derivation: "Thismia" was the word developed, by inversion, to commemorate Mr. Thomas Smith, who had worked on plant structures earlier in the century. In 1851, another species was described, under another name, by a second Englishman, whose son found the specimens growing on decayed tree-trunks, in deep shady woods in Brazil. The relationship to the other form previously found in the distant Malay region was recognized readily by the second worker, Miers, who later found another species. Since that time, one form after another has been discovered with intervals of time between, in rather similar situations in rich, moist, tropical forests, as in Brazil, Ceylon, Java and New Guinea. Then suddenly, in a somewhat different habitat, tho in the same general region as previously, a new species was found in Tasmania, in 1891, another in New Zealand in 1908. The number of species discovered from 1834 to 1908 included fifteen forms, mostly in the Polynesia-Malay region, with outlying forms in Brazil and Africa.

The next and last form reported was discovered four years later in a country that would not be suspected, a priori, of harboring a member of a family so almost exclusively tropical. The occurrence in Chicago of a form evidently very closely allied to other Thismias, and yet distinct from its relatives in size, coloring, and details of

Fig. 1

Fig. 3

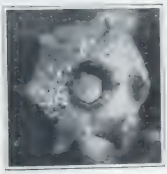


Fig. 2

Fig. 4

structure, seems almost mysterious. One may theorize almost indefinitely as to how such a geographic distribution resulted. And one may come to the conclusion that there are probably other forms bridging the geographic spaces, but still undiscovered.*

If this be true, there must be some particular reason for the slow finding of forms. The lack of fairly intensive work happens not to be the cause in the Chicago region. Rather, in this case, it is the smallness of the plants themselves. In tropical regions another cause has been found in the ephemeral nature of the forms of the Thismias. They are usually only evident at the time of flower production, when the brightly colored flowers, often brilliant in combination of chrome and rose, or in simple yelow or flesh-color, combined with white, appear. Unlike most plants familiar to us, no green coloring develops, so that the plants are dependent on other sources for food-supply. Coupled with this is the subterranean character of the plant body until the time of flower production, when the floral axis protrudes from the humus or decayed tree-trunk. Obviously, if the bloom lasts but a short time, there is a large chance that the casual observer will miss the plant entirely. Truly intensive work is important here. After the petals fade, they fall off, and the small fruit which remains is inconspicuous, so that it is readily passed over.

In the case of our North American form, the dimensions of the plant appear even smaller than in most tropical forms. As a matter of fact, all of the short floral stalk and the basal portion of the flower are underground, with only the delicately colored upper part evident. The young buds are white, developing later a delicate blue-green in the upper part of the flower. The structure of the flower is quite different from that in forms with which most of us are familiar, but may be seen somewhat clearly in photographs of views from the side and above. (See accompanying plate.) The petals, which are grown together at the top, are distinctly separate 2-3 mm., while the total height of the flower is only 1-1.5 cm. at best. It is evident that when not bearing a flower, the organism would defy detection, unless one uncovered the roots, as shown in fig 4. Even then, relationships would not be clear, since these are determined most readily by the reproductive parts.

The general characteristics of such a group of plants as this one

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* Dr. Pfeiffer's modesty prevents her from saying that the discovery mentioned here was made by herself. It does not seem quite fair to the reader that this information be withheld. "The Morphology of Thismia (Bagnesia) Americana, a New Species" was the subject of Dr. Pfeiffer's doctorate thesis.—(Editor.)

undoubtedly call for different tactics in hunting them down from those required in enumerating larger, more persistent or more evident forms. But the methods are such as are natural to any one. For those of us who have not access to wide displays of fossil forms, with the technical knowledge required to take advantage of them, who have not the opportunity to develop new species in a cultural way, or who are unable to experience the pleasures with the attendant hardships, of the botanical excursion into unexplored country, there still remain the regions about us. In these areas, withal they have been cursorily examined, there may exist at the present time, forms as yet undreamed of. And only in the rounding out of our knowledge of such forms will our total knowledge be perfected.

The Use of the Long Single Wire Aerial

ALBERT HOYT TAYLOR,

Professor of Physics, University of North Dakota

A GOOD many amateur radio stations using relatively small T type or inverted L type aerials find considerable difficulty at any time of the year excepting, perhaps, the mid-winter period of unusually good transmission, in receiving signals of very long wavelength, emitted by distant stations. Now, it can readily be shown that while the strength of the received signals is proportional to the height to the center of the capacity of the receiving aerial, the strength of the signals is also inversely proportional to the effective resistance of the receiving aerial. This is on the assumption that the effect of the received wave on the aerial is to generate an E. M. F. proportional to the height of the aerial.

It will be seen from the consideration of the influence of height as well as the influence of the equivalent resistance, that height may be more or less compensated for by a reduction in the equivalent resistance. This may be accomplished by the adding of capacity to the aerial in the place of using the usual loading coil for receiving long waves. There are, of course, two means of tuning an aerial to long waves: one, by increasing its inductance, that is to say, by the use of a loading coil, and the other by increasing its capacity. When the latter is done by the use of a condenser placed in parallel with the receiving transformer primary, a loss of efficiency follows, the loading coil giving better results.

If, however, the additional capacity is overhead capacity, the aerial becomes very much more efficient than when used with a loading coil and a smaller overhead capacity. It is assumed for the sake of argument that the height to the center of capacity remains constant. One reason why the addition of overhead capacity is so much more effective is because, when added overhead, the aerial acquires a greater coupling with the others. That is to say, it draws energy from a larger region of the wave. It seems clear that this is the only logical explanation of the superiority of the overhead capacity, when the height to the center of capacity remains unchanged.

In accordance with the reasons here advanced, some experiments were undertaken during the month of April at this station to determine the relative efficiency of long waves of two aerials of very widely

different type. One of these was the regular aerial consisting of five 7 strand No. 22 phosphor bronze aerial cable, making a grid of 150 feet long and 12 feet wide. The height to the center of this grid is 85 feet, and the lead-in is taken off about one-third way from the near end. In order to tune to the 2,500 meter wave of Arlington or the 2,800 meter wave of Sayville, it was necessary, of course, to use a large loading coil with this aerial. The loading coil was made up of four sections with dead-end switches. The loading coil was constructed of No. 16 stranded incandescent light cord, thus reducing losses from skin effect to a minimum. The second aerial consisted of a single 7 strand, No. 22 aerial wire, 800 feet long, stretched between a chimney 120 feet tall and the top of Science Hall, 60 feet from the ground. The lead-in was taken from the 60 foot end. The receiving set was the same in both instances. The detectors were audions used singly or in cascade, that is to say, the second one amplifying the signals of the first. It must be noted that this aerial points about 20 degrees east of south. It is then directed unfavorably for Arlington, Virginia, and Sayville, New York. In spite of this fact, it was found from comparative shunts that for these long waves the 800 single wire aerial was from five to six times as efficient as the grid.

This experiment demonstrates that amateurs in radio communication can obtain excellent results with a very simple type of aerial and one that is erected with very little trouble or expense. This type of aerial is, however, very far from being efficient on short waves. It was found that no waves shorter than 900 meters could be received better on the long aerial than on the short one. The 3,500 meter wave of Arlington was received on the long aerial in the day time. It was quite impossible to hear it, even with two audions, on the short aerial.

In order to test the theory mentioned in the first part of this paper, the equivalent resistance of the long aerial was determined and was found to be less than one-half that of the short aerial. The fact that its efficiency was five or six times as great must therefore be attributed not only to this reduction in equivalent resistance but, as well, to the increased coupling which it makes with the ether.

Some experiments were also made using the single wire as a sending aerial, the wave-length being about 1,000 meters. Mr. James Doran, of Bismarck, North Dakota, distant 200 miles, reported this wave nearly as strong in the day time as the regular 500 meter wave used for the weather service. The power was four kilo-watts in each case. The long single wire aerial used as

a sender is liable to have a decrement undesirably high unless used with a loading coil. This is due to its resistance which is greater than the resistance of the grid.

To summarize the experiments made at this station, we see that for the reception of long waves, such as the 1,800 meter wave of Key West, the 2,500 and 3,000 meter waves of Arlington, and the 2,800 of Sayville, the single long aerial is superior (even when directed unfavorably) to the shorter grid aerial.* The long aerial is *not* as efficient as a sender of short waves, and even when sending long waves is liable to have too large a decrement. It is also inefficient for the reception of short waves, such as the 600 meter waves of the regular coast-line stations. In conclusion, it may be stated that this long aerial has now been replaced by a three-wire aerial of the same length. This aerial is efficient on any wave from 1,600 meters up, and is an excellent sender with a satisfactory decrement of a wave on 1,400 meters.

So far, no long distance tests have been undertaken with this wave, altho tests with Washington University at St. Louis and with the University of Michigan are under consideration for the near future.

The capacity of the three-wire aerial, 800 feet in length, is 13×10^{-3} Mf., and that of the five-wire, 150 feet in length, is 13×10^{-4} Mf. It is interesting to note that their efficiencies on long waves are about in the ratio of their capacities

* If the lead-in be taken from the center of the long wire it will, of course, handle shorter waves. In case the lead-in must be taken from one end, it is best to take it from that end which is nearest the sending station.

The Coal and Clay Resources of North Dakota

EARLE J. BARCOCK,

Dean of the College of Mining Engineering, University of North Dakota

NORTH DAKOTA has good reason to be proud of the position which she occupies in the agricultural and stock raising industries. Indeed, the great prominence and wonderful development enjoyed by this state in these industries have caused most people to overlook the possibilities which exist in the development of other natural resources and industries.

Altho North Dakota is not a metal producing state and may never become a *great* mining state, it certainly possesses some mineral resources, especially its great coal and clay deposits, which are sure to become more extensively used and to prove of great economic value.

The research, discovery, and development of the best methods for the utilization of these resources require time, patience, hard work, and technical skill. But these efforts are gradually leading to not only a more economical and wider use of these resources but also to the establishing of associated industries.

COAL

Something is known of ahe vast deposits of lignite coal which are found within the State of North Dakota, but it is surprising how little the immense value of these deposits is appreciated. There is a very large area in the western part of this state which is underlaid with quite thick deposits of lignite coal. Whether the outcrops which have been discovered are fragments of one immense coal basin which has been broken up by water action and covered by newer formations, or whether they are deposits of numerous woody swamps of the same geological period, we may not at present determine with certainty, but we may be sure that North Dakota has enough coal, if properly used, to supply her fuel needs for generations.

North Dakota has one of the largest coal areas of the states of the Union, estimated at 32,000 square miles and capable of producing probably 500 billion tons. While many mines have been opened in different localities, the deposits are for the most part undeveloped. Altho these deposits are in a general way similar, still they vary

somewhat in both physical and chemical properties in different localities. Usually the coal is of a brownish, black color, seldom having much lustre. Occasionally, however, seams are encountered which are more compact and have a darker color and brighter lustre. The seams most commonly worked usually appear at from 50 to 200 feet below the surface and vary in thickness, being from 7 to 20 feet.

From many hundreds of analyses of lignite coal made in the laboratories of the School of Mines at the University of North Dakota, the average composition of the dried coal would seem to be about as follows:

Dried Coal	Approximate average
Fixed Carbon	47 per cent.
Volatile Matter	44 " "
Ash	9 " "

Moisture in coal fresh from the mine runs from 25 to 35 per cent.

It is evident from the investigations which have been carried on at the School of Mines that the heat value or calorific power of the average lignite of North Dakota, when entirely dry, is about 65 per cent of that of the Hocking Valley coal, and about 60 per cent of that of the Pocahontas coal. The analyses which have been made show that the fixed carbon in the samples of North Dakota coal (dried) usually runs from 48 to 52 per cent; that of West Virginia bituminous coals about 67 per cent; that of the better grades of semi-bituminous dry coals of Maryland 75 per cent; and that of the fine, dry, close burning bituminous coals of Pennsylvania 70 per cent. In a general way it may be said that the heating power of one ton of North Dakota coal will equal about 65 per cent of a ton (1300 lbs.) of bituminous coal.

The purity of a fuel is a very important element in determining its value. A difference of 2 or 3 per cent in the earthy matter of two coals may be the source of a very serious difference in their final value. North Dakota coals are almost always very free from earthy matter as seen from the amount and character of their ash.

By these comparisons it will be seen that North Dakota lignite ranks, so far as its heat producing power is concerned, between the lower grades of lignite and a bituminous coal, and that it is far superior to the lignite mined in some countries.

It is largely due to a lack of familiarity with the character of lignite coal and to a lack of knowledge of the best methods of burning it, that this coal is not being more generally used. However, the

use is gradually being extended as from time to time more perfect methods of burning appear.

At the present time lignite coal is chiefly used in lumps in heating and cooking stoves and in engines for power. It is generally used in the most simple manner and very few special methods have been adopted for burning or utilizing this coal or for preparing it for the market. But there can be little doubt that for general stove and furnace use briquetted lignite would prove a most economic and profitable fuel.

A successful and sufficiently inexpensive method for commercial briquetting of lignite is now being developed at the School of Mines. The process is made commercially possible and profitable by operating the briquetting in conjunction with a gas producing plant in which a variety of by-products are saved and utilized, and by which process the residue after the gas has been driven off can be successfully briquetted into a concentrated and valuable fuel.

One ton of the dry lignite will produce about two-thirds of a ton of briquets, in addition to about 8,000 to 10,000 cubic feet of gas and other valuable by-products such as tars, ammonium sulphate, etc. Considering the ease with which the gas is produced, the low cost of the original lignite, and the value of the residue, this gas should have a large commercial value for heating and power purposes because of the low price for which it could be obtained if manufactured in a plant used also to produce briquets from the residue.

The briquets present many advantages over the original lignite or even over other varieties of coal. They have nearly double the heating value of the original lignite, they do not disintegrate on standing or burning, can be stored without being affected by atmospheric conditions, and are uniform in size and convenient to handle.

There seems little doubt but that the briquetting and the production of gas from lignite will in the near future be put on a commercially satisfactory basis in this state. While this will prove of great value to all parts of our state, it will be especially important to those communities nearest the great lignite deposits in the western portion of the state, for in some of these the wastes can be converted into electricity which in turn can be sent to surrounding towns and villages, thus distributing power and light from numerous central power plants. Such an arrangement will not only be a great saving of our fuel resources but will also result in establishing many industries which can be developed by abundant and cheap electric power.

CLAY

Among the mineral resources of the state, the clays are second only in extent and economic value to our coal deposits. North Dakota is remarkably well supplied with a variety of valuable clays suited to the manufacture of many important products. These deposits are quite extensive, especially in the western portion of the state, and many of them are found not far from the lignite coal beds, a fact which will greatly enhance the value of both deposits.

There is an unusually large number of varieties of clays found in this state ranging from common brick clay to deposits suited to the production of a very high grade art pottery. A great deal of work has been done at the School of Mines in the testing of these clays and in making them into a variety of products for which they are found adapted, such as brick, terra-cotta, paving brick, fire brick, and other refractory materials, drain tile, stoneware, sewer pipe, earthenware, and the higher grades of art pottery. Clays are found well suited to the manufacture of all of these products and many of them are of exceptionally high grade. As an illustration I give the following analysis of white earthenware clay from North Dakota:

Silica	70.27	per cent.
Alumina	20.81	" "
Iron Oxide	0.33	" "
Calcium Oxide	0.23	" "
Magnesium Oxide	0.26	" "
Loss on ignition	6.38	" "

As will be seen by referring to the above analysis, some of the clays of North Dakota are of unusual purity and also are remarkable in having a composition, in their natural state, very similar to many of the artificially prepared clay bodies, used in potteries, which have been built up to their proper composition, often by the use of several mixtures. For example the following analysis is of a sample of the artificially prepared mixture just ready to go to the molds in one of the large eastern factories:

Silica	69.03	per cent.
Alumina	23.89	" "
Iron oxide	0.45	" "
Calcium oxide	0.29	" "
Magnesia	0.05	" "
Loss on ignition	7.46	" "

By comparing this analysis with that of the North Dakota white earthenware clay it will be seen that the sample of North Dakota

clay as dug, is very pure and that there is a striking similarity in composition to that of the artificially prepared pottery mixture referred to. And as might be expected, many of the high grade clays of this character from the state are capable of producing pottery and other clay products of exceptionally high quality. Few people appreciate the remarkable character of many of the clays of western North Dakota and the important part they are to play in the future development of the state.

The proper development and utilization of the great coal and clay deposits of North Dakota and the use of lignite for the production of cheap power and electricity by the introduction of by-product gas and briquetting plants, and by other means of utilizing these resources, will result in saving large sums of money for the people of this state and in the introduction of a variety of manufacturing industries, a condition which will add greatly to the stability and prosperity of a region already well known for its agricultural resources and possibilities.

Book Reviews

THE THEORY OF HEAT RADIATION: MAX PLANCK, Professor of Theoretical Physics, University of Berlin. Authorized Translation by Dr. M. MASIUS, Instructor in Physics, Worcester Polytechnic Institute. P. Blakiston's Son & Co., Philadelphia, Pennsylvania, 1914. XIV + 225 pp. Price, $2.00.

Perhaps no book in the realm of the physical sciences since the contributions of Maxwell to electricity and magnetism has called forth more comment than Professor Planck's *Vorlesungen uber die Theorie der Wärmestrahlung*. The comment has been both favorable and unfavorable owing to the radical nature of the treatment of the subject matter and the small amount of experimental data available at the time of publication of the first edition.

The treatment of the subject matter in the first edition begins with the elementary experimental laws of optics and proceeds by extension and addition of the results of electrodynamics and thermo-dynamics to the problems of spectral distribution and irreversibility. The treatment of the subject was regarded as extremely radical and arbitrary and met with anything but general acceptance. However, the radiation formula for spectral distribution has stood all the tests of refined and systematic mesurements and recent advances in physical science has been favorable to the special theory outlined in the first edition.

Professor Planck feeling that the demands of experimental evidence required a change in the treatment of parts of the subject has put forth the second and revised edition (1913). This edition has freed itself from the classical thermodynamical laws of emission and absorption and the assumption of finite energy elements has been introduced. Recent advances in other physical theories have placed the assumption of finite energy elements or quanta of action introduced by Professor Planck in the foreground. Attempts to obtain direct experimental evidence for the Quantum Theory have made their appearance in the literature not only in the field of radiation but in other fields of Physics. Its bearing upon the theory of the equipartition of energy, the theory of specific heat and upon the photoelectric effect have all been discust with some favor.

This review has to do however with the English translation of the second edition of the *Wärmestrahlung* by Dr. M. Masius. The translation is welcomed altho most all English speaking physicists

read the German with more or less facility. At times when the thought is involved and so entirely new as it is in Professor Planck's book, it is much easier to follow when written in one's more familiar tongue.

Dr. Masius has given us a translation which follows the German very closely. This is to be commended since the volume is an important one and new in its treatment and concepts. One feels that it is a very close translation for the sentences are at times rather long and involved and other characteristics of the German have been carried over into the English.

The translator has added an appendix giving some deductions from the Stirling Formula which are helpful in reading certain parts of the book. In another appendix is included a bibliography treating of the Quantum Theory in its application to other fields of Physics.

The translation is carefully prepared and contains practically no errors except those included in a very short list of Errata. The volume is undoubtedly welcomed not only by those who are deeply interested in the subject of heat radiation but also by those who are interested in the application of the theories contained to other fields of the physical sciences.

B. J. Spence

Department of Physics,
University of North Dakota

Matter and Some Of Its Dimensions: William Kearney Carr. Harper & Brothers, New York and London, 1913. 120 pp. Price, 75c.

This book is one of a series dealing with current philosophical, religious, and scientific interests, and called Harper's Library of Living Thought.

The author begins with a very clear discussion of the modern theory of matter as imponderable atoms composed of infinitely small stresses of ether whirling at great speed, called electrons. The speed of the electrons varies from slowest on the atom's periphery to fastest at its center, and whenever the speed of light is approximated the electron is emitted from the atom. The author points out that the conditions which obtain in radium substantiate the electron theory. The transmutation of lead into a gas under great heat and its final disappearance, probably into the ultimate ether, is another substantiation of the theory.

This solid scientific foundation is to support the author's theory

of the super-physical. He accepts the mathematical conception of an ether of five grades of lightness, and supposes that the material bodies are made of the heaviest ether, and subliminal to this lie the other ethers in their gradations of lightness. Thus every substance, every human body has five grades of existence.

The electrons of the first grade are of the physical world; those of the second grade are of the metaphysical world. Death removes the body from the first grade existence and gives it the second. The individuality of the first grade is propagated by cell-division and is so dissolved; that of the second is indissoluble and eternal. Therefore he is lost who cultivates the first grade life.

Carrying the thought farther the author offers the hypothesis that all invisible processes of this world transpire not in our three dimensions but in the fourth dimension. Our physical minds see the solid phenomena but the brain of the fourth dimensional body sees the electron manifesting the life. The mind of hypnosis, of somnambulism, and of the trance, stript of the material body, enter into this refinement. Furthermore, the brain of the fourth dimensional consciousness intelligently operates all the unconscious actions of the body, explains our instinctive or unlearned behavior, and renders the "orthodox" explanation of reflex action absurd. Yet, not matter how stimulating to the imagination this explanation may be, it nevertheless seems to us that a reflex is more nearly explained by calling it the result of nerve irritability than by saying it is the manifestation of the fourth dimensional mind. And the best that an "orthodox" psychologist can say about the author's explanations of the occult is that they are stimulating to the imagination.

JOHN W. TODD

Department of Philosophy and Psychology,
University of North Dakota

MIRACLES OF SCIENCE: HENRY SMITH WILLIAMS. Harper and Brothers, New York and London, 1913. 343 pp. Price, $2.00 *net*.

The layman who is sufficiently broadminded to desire some general idea of the advances in human progress is more or less dimly aware that during the past few years there has been enormous progress in science and invention. He appreciates that scientific men have learned to speak cautiously about immutable laws and have come to consider scientific views as in a state of change, the new rapidly supplanting the old in the light of succeeding experiments.

In his introduction Dr. Williams aptly comments upon the fact that, altho "every period of history is a transition period," yet "great events tend to cluster." Certain generations seem to mark time and others are full of creative effort. The first decade of the twentieth century is termed "vital and generative—a time of great activity in the field of natural sciences, theoretical and applied." The man of affairs who recalls the science he learned a few years ago in the schools has no difficulty in realizing from comment in the press and from occasional articles that the investigators of the present day have abandoned many of the old conceptions, that they are using terms non-existent a few years ago and that the scientific notions of 1890 are in many ways as antiquated as those of the medieval alchemists. The whole frontier of the unknown has been pushed "so far beyond what formerly seemed the bounds of the possible" that the new facts almost challenge belief. Never before in the world's history have the viewpoints in many lines changed so rapidly and so continually as to be almost kaleidoscopic. The centuries' old theory of LaPlace has given way to the planetesimal of Chamberlain, electrons have supplanted atoms, the biologist has caused unfertilized germs to grow, wireless telegraphy which some of our scientists were recently limiting to a radius of a few miles has leaped across oceans, Langley's folly which was ridiculed within the memory of students yet in school has become the aeroplane of today which soars higher than the eagle and contemplates a transatlantic flight,—and the list might be prolonged. It is a miraculous age and men stand in momentary wonder what new marvels the investigators may wrest from Nature.

The revelations have come so suddenly and in such rapid succession, they touch human life and its interests so vitally that the world at large has clamored for information. The public press and the periodicals have teemed with feature articles in many cases bordering on the sensational. Such have usually possest a germ of truth but are so often the composition of the reporter unskilled in interpreting the statements of the scientists that they fail to give an accurate and intelligible notion to the mind of the layman. Not only are the revelations new, but the terms that have been coined to express them are myriad and require in themselves the explanation which the scientist alone can give.

In *Miracles of Science* Dr. Williams, the author of *The Story of Nineteenth Century Science*, attempts to give an account of the achievements since 1900. His first three chapters on *The Origin of the World*, *Charting the Universe*, and *Weighing the Worlds*, have

to do with modern astronomical science. We have a readable account of the new theory of Professor Chamberlain, the description of the marvellous instruments which the modern investigator uses, learn of their use and are afforded some glimpse of the majesty of time, space and magnitude of the universe revealed by the enormous telescopes recently constructed.

Turning from the infinite to the infinitesimal, in the chapter *Exploring the Atom*, Dr. Williams explains the tremendous changes that are the result of modern chemical and physical investigation. Ions, electrons and radioactivity are all given an interpretation intelligible to the lay mind and some indication is afforded to the possible results that may be attained in the future.

In the chapter *Juggling with Life* there is a description of the work of Professors Loeb and Nuttall, Dr. Alexis Carrol and others whose biological investigations have attracted so much popular attention on account of their vital interest. They have been exploited in the press with much sensational advertisement that is happily absent from Dr. Williams' account. There is no line of investigation that possesses more significance than that of these biologists. It touches upon the mystery of life and holds promise for the alleviation of the ills of mankind so that it is no wonder that humanity wishes to have the truth.

The succeeding chapter on the *Creation of Species* is closely connected with the one just mentioned. In it are recounted the labors of Patten and Davenport, and the Mendelian theory of which we hear so much is described in detail with suitable illustrations. Dr. Williams does much to lift the science of eugenics from its misunderstood and ridiculed position to one of scientific importance and adequate popular comprehension.

A continuation of the biological line is the chapter *Banishing the Plagues* which is popularly most valuable, since it recounts the efforts made to eliminate the scourges which afflict mankind, relates intelligibly how immunization is secured and urges a more general use of the aids which scientific experiment has discovered for the prevention of contagious diseases.

The last three chapters on *Working Wonders with a Top, The Conquest of Time and Space*, and *Our Wonderful Generation* relate particularly to the marvelous inventions of recent years. The gyroscope, its principles and its applications, are given the clearest explanation that we have seen in any work. The same is true of the wireless telegraph and telephone and the aeroplane. Quite remarkable is the absolute fairness shown in the treatment. Both the men

who discovered the principles upon which these instruments rest and those to whom belongs the glory of applying them receive their just due. Hertz is not forgotten for Marconi, and Langley, Lilienthal and Santos Dumont receive a place by the side of the Wright brothers.

The tests of any such work as that of Dr. Williams are its accuracy and its intelligibility. *Miracles of Science* is dispassionate and is sensational only to the extent that the achievements it records are sensational. It is scientific in its presentation of facts and adequately indicates the points of caution, the places where the investigator suggests varying interpretations. Dr. Williams has been remarkably successful in giving the gist of things, eliminating the formulas intelligible only to the technical reader. The layman can understand perfectly his description of instruments and methods; the difficult problem of interpreting the host of new terms is successfully solved every time. No more satisfactory and readable book in the line of popularizing scientific ideas has come under the reviewer's eyes in recent years. It is clear, it is precise, it is stimulating,—what more can be said?

It is regrettable that the book has not been read more carefully in proof for typographical errors. There are frequent misspelled words and in several instances lines have been misplaced. That such mistakes are to be found in a work on science is unfortunate and they will, of course, be corrected in another edition. Nevertheless, they detract but slightly from the value of the book to the layman who desires a true account of what our research men are doing to lift the veil of the unknown

H. R. Brush

Department of Romance Languages,
University of North Dakota

Exercises in Bacteriology and Diagnosis for Veterinary Students and Practitioners: Veranus A. Moore, Director of the New York State Veterinary College at Cornell University, and Clifford P. Fitch, Assistant Professor of Bacteriology, New York State Veterinary College. Ginn and Company, Boston, 1914. XXII + 154 pp. Price, $1.00.

This little book is designed especially for the student in Veterinary Medicine. The title on the cover is somewhat misleading as it gives the impression that the book deals with Bacteriology in gen-

eral. It would serve its purpose much better if the title, which is found on the title page, appeared also on the cover.

The book is divided, the first part dealing with bacteriological technic and the characteristics of bacteria related to Veterinary Medicine. The second part covers the methods of diagnosis in such diseases as Actinomycosis, Glanders, Hog Cholera, Rabies, etc.

L. D. Bristol

Department of Bacteriology,
University of North Dakota

A Manual of Bacteriology for Agricultural and General Science Student: Howard S. Reed, Professor of Mycology and Bacteriology, Virginia Polytechnic Institute. Ginn and Company, Boston, 1914. XII + 179 pp. Price, $1.25.

The word "Manual" is described as a "compact volume," an "elementary text-book," a "primer," by our best authorities. Certainly this book is a compact, elementary text-book. Its specific purpose—for agricultural and general science students—should appear on the cover.

The book contains one hundred and seventy-nine pages, and nearly a third of this number are given over to sixteen appendices. It might occur to some that the book is suffering from too much "appendix" and that an operation would have a beneficial effect.

The subject matter is clear and apparently accurate. At the end of the book is a convenient paper Plate counter.

L. D. Brsitol

Department of Bacteriology,
University of North Dakota

Modern Problems of Biology: Charles Sedgwick Minot, Director of the Anatomical Laboratories, Harvard Medical School; Exchange Professor at the Universities of Berlin and Jena, 1912-1913. Fifty-three illustrations. P. Blakiston's Son and Company, Philadelphia, Pennsylvania, 1913. X + 124 pp. Price, $1.25 *net*.

This little book consists of six lectures delivered by the author as Harvard Exchange Professor at the University of Jena in 1912. Their purpose is, as stated in the preface, the presentation of new biological discoveries, mainly by American workers, to a mixed public. In the first of these, which serves "as an introduction rendering

it easier for non-biologists to understand the following lectures," the author gives a general discussion of the cell in its structure and activities, emphasizing the fact that "the chief problem of biology (is) the investigation of the structure and chemical composition, not of cells but of the living substance." His statement that this is a "new" doctrine is perhaps a little misleading in the sense in which "new" is commonly employed in relation to scientific discovery today.

Lecture II, entitled "Cytomorphosis," is a continuation of the preceding lecture dealing with the changes which cells undergo in development. The author concluded "that living substance possessses an organization, and probably without organization life is impossible."

The third lecture is presented under the misleading title of "The Doctrine of Immortality." All biologists recognize the fact that protoplasm is immortal. Otherwise, life would soon cease to exist. But the layman, for whose benefit these lectures were prepared, has a very different conception of "immortality" from that of the biologist.

As a titular antithesis to the last lecture we have that of Lecture IV, namely "The Evolution of Death." The author maintains that unicellular organisms do not die (a view which is open to question) but that death has evolved as a result of differentiation in higher forms. In this lecture is presented his interesting theory according to which old age is a phenomenon of decreasing growth rate, and the anomalous fact is brought out that young animals grow old faster than old ones; i.e., the growth rate decreases much more rapidly in youth than in old age. Thus in man the yearly increase in weight during the first year is over 200%, during the second year about 25%, during the third year 20%, etc. becoming nil after the 23rd year. In guinea pigs four days old the daily gain is 5%, while at the end of a year it is almost zero. A critic might ask, however, if this theory does not confound the process of becoming mature with that of growing old. Are they indeed the same? In this same lecture a number of other theories of old age are discust, including the well known one of Metschnikoff, which the author regards as "highly improbable." He concludes with the question "Has Death a purpose?" and the admission that the biologist knows the essence of death no better than the essence of life.

In lecture four, "The Determination of Sex," are presented the results of investigations, chiefly American, which tend to show that sex is predetermined in the egg and cannot be determined experimentally, all that can be done by experiment being to render

conditions more favorable for the development of one sex than the other.

To the reviewer the most interesting lecture of the six is the last, "The Conception of Life," wherein are discust the much mooted questions as to the origin of life, the mechanistic versus the vitalistic explanation of life and the possibility of the existence of life without a material basis (spiritualism). The author does not commit himself in favor of either the mechanistic or the vitalistic hypothesis, but wisely takes a middle ground. He says "whether it (the mechanistic hypothesis) is sufficient to explain all the phenomena of life is a question in regard to which opinions diverge----------there are biologists who make a dogma of the mechanistic theory and defend their doctrine with a vehemence which recalls the theological discussions of the Middle Ages----------We, however, must consider the question more quietly and remain remote from overeagerness, and this chiefly because there are important vital phenomena known to us which up to the present at least cannot be made comprehensible by the mechanistic theory." Of these phenomena he mentions three: organization, the teleological mechanism, and consciousness. The first of these is admittedly present in all life, but is it entirely absent in the non-living world? As to teleology, are all the structures of living things purposeful in character, the freckles on one's nose, for example? Is consciousness so present in a Bacterium or an Amoeba? The author would have done better to have emphasized metabolism and reproduction as the principal characteristics of life.

With his statement that "biologists are not philosophers" the reviewer begs to disagree unless "some" be prefixt thereto.

Taken as a whole this little volume is very readable and has in its suggestiveness the contents of many books many times its size. It is a very pleasing example of the book-maker's art. Some of the illustrations, however, are unfortunately marred by the omission of the lettering or the explanation (figures 8 and 14).

R. T. Young

Department of Biology,
University of North Dakota

University Notes

University Promotions and Appointments At Commencement time President McVey announced the following promotions in the different colleges of the University:

Professor E. F. Chandler, for many years Professor of Mathematics, to be Professor of Civil Engineering, the Department of Mathematics having been divided;

Mr. George R. Davies to be Assistant Professor of History and Sociology;

Mr. E. C. Griess to be Assistant Professor of Mechanical Drawing;

Dr. F. H. Heath to be Assistant Professor of Chemistry;

Assistant Professor Raymond R. Hitchcock to be Associate Professor of Mathematics, in charge of the Department;

Assistant Professor Frederick H. Koch to be Associate Professor of Dramatic Literature;

Assistant Professor W. W. Norton, in charge of the Department of Music, to be Associate Professor of Music, in charge of the Department;

Mr. J. F. Stevens to be Assistant Professor of Mechanical Engineering.

In the Model High School, the resignations of Misses Black and Balch and Mr. Hunsaker to pursue graduate work at Columbia and that of Mr. Tasso Lindsey to go into business in Florida, left four positions vacant. The work of these men and women has been efficient and the University parts with them with regret. From a highly successful experience in the teaching of English in the Grand Forks High School Miss Edna Twamley comes to the corresponding position in the University. Miss Martha E. Brodby, late in charge of mathematics in the high school at Red Wing, Minnesota, is to take the position made vacant by Miss Balch's resignation. Mr. Albert T. Vollweiler of the Hibbing High School takes the work in history and civics, and Mr. V. E. Sayre accepts the position in manual training as the successor of Mr. Lindsey. It is interesting to state in connection with the purpose of the school that these new comers have in each instance followed graduate work in some of the best universities of the country.

A marked change will be noticed in the faculty of the Law School. Professor Joseph L. Lewinsohn resigned early in the year and is now engaged in the practise of law in Los Angeles, California. Dean Robert L. Henry resigned shortly after the close of the year and

soon accepted a more desirable position in the Law School of the University of Iowa. Professor Charles E. Carpenter who had been with the University for six years has accepted a similar position in the Law School of the University of Illinois at a flattering increase of salary. The places thus made vacant have been filled by the following men: Professor Birdzell who has been away on a two-year leave of absence, acting as Chairman of the State Tax Commission, returns to his old position filled for the two years by Professor Lewinsohn. Professor George F. Wells, of the Law School of the University of West Virginia, was chosen as Dean of the Law School. Dean Wells is a graduate of the University of Michigan and has had a long experience as a practising lawyer in addition to his teaching experience as a law professor. The successor of Professor Carpenter is Dr. Laurig Vold, a Doctor of Science of Jurisprudence of the Harvard Law School. Dr. Vold comes highly recommended.

The department of Physical Education is to be strengthened by the addition of a field coach, with the title of Assistant Director of Athletics. To this interesting position, Mr. T. Andrew Gill comes from Albion College, Michigan, where he was highly successful as a coach of athletics. Mr. Gill is a graduate of the University of Indiana, played on the first teams of that school and, in 1912, was given a place on the All-American foot-ball team by Walter Camp. Mr. Gill's coming promises a bright future for athletics in the University.

When Miss Treen resigned her position as Manager of the University Commons, the University lost an efficient business woman who had served the University loyally for eight years. She goes to Columbia for graduate work. Miss Lillian Bullock, a graduate of the Boston School of Domestic Science and Manager of College Hall at Wellesley College during the past two years, succeeds Miss Treen

It was also with regret that the resignations of Mr. J. J. Pettijohn, Director of the Extension Division, and of Miss Grace Thompson, Mr. Pettijohn's assistant, were accepted. They have accepted similar positions, but with increased salaries and with more money with which to develop the work, in the University of Indiana. Their places have been filled by Dr. F. C. English, from the presidency of William and Vashti College, and William H. Greenleaf of the class of 1911, University of North Dakota.

The 1914 Summer Session As stated in the University Notes of the July number of the QUARTERLY JOURNAL, the Summer Session of the University has come to be regarded as a per-

manent feature of the yearly program. It is now coming to be planned for and looked forward to as definitely as either of the two regular semesters. It has come to serve a very useful purpose for many people, and in many ways. Neither students in the University nor teachers in the schools of the state need so long a vacation as from the first or the middle of June to the middle or the last of September. Many individuals of each group are beginning to appreciate this fact and to plan for a more profitable use of a portion of the time. University students plan to cut short, by summer attendance, the period of time necessary for graduation. Of the teachers in the schools of the state, many are seeing in the summer session an opportunity both to equip themselves better for their work and also to complete the work necessary to obtain that long coveted certificate or degree.

The College Section of the Summer Session was organized in 1910, and has therefore been in operation five years. The attendance has been as follows: 1910, 60; 1911, 74; 1912, 88; 1913, 96; and 1914, 121. The growth, while not rapid, has been steady and consistent, that of the session just closed being the most marked, an increase of 26% over that of 1913. There are good reasons for thinking that this growth will continue.

An analysis of the student body and of the work elected present some matters of interest. Of the 121 students enrolled, 60 were men and 61 women. Forty-five of the number were regularly enrolled students of last year, 29 were former students who returned for additional work (16 of these had been in attendance upon summer sessions alone), and the remaining 47 were wholly new to the institution. Of the 121, 61 will teach during the coming year and 60 attend school, 58 at the University of North Dakota and 2 elsewhere. Of the teachers present, 18 were principals, or superintendents, from various parts of the state, a particularly desirable class of students from many points of view.

Another interesting feature of the work was the enrollment at the Biological Station at Devils Lake. Unexcelled facilities are found there for work in Biology and Geology, a fact appreciated by students this year apparently for the first time. Thirteen students were enrolled for regular work and many others as visitors. All, students and instructors alike, are enthusiastic over the situation. It points to larger things for the future.

The entire election of work covered 250 courses aggregating 668 credit hours. The election by subjects was as follows:

Biology	8	History	5
Chemistry	10	Home Economics	14
Economics	8	Manual Training	12
Education	58	Mechanical Drawing	7
English	29	Physical Education	31
Fine Arts	8	Physics	7
French	3	Psychology	15
Geology	10	Sociology	16
German	8	Spanish	1

The Biological Station The Biological Station at Devils Lake was established by the State Legislature during its session of 1909, and placed under the control of the University to be directed by its Biological Department. Its general purpose is to study the animal and vegetable life of the state, especially as found in its waters. It was therefore located on the shores of Devils Lake, the largest body of water in the state, and in a region particularly rich in both kinds of life to be studied. It was also hoped that, in addition to the gaining of scientific knowledge which would eventually be useful, more immediate and practical benefits might result. This fact is very clearly shown in a section of the Bill itself:

"It shall be the duty of the staff of the said station, as directors thereof, to study the plants and animals in Devils Lake and other portions of North Dakota with reference to the problem of restocking and cultivating fish in Devils Lake and in any other waters of the state, especially those of an alkaline character; to study and make collections of any animals and plants in North Dakota that have commercial and scientific value."

The Station is well equipt with a commodious and well-appointed building having laboratory, library, museum, and lecture room conveniences, also with all needed apparatus for the successful prosecution of such work as contemplated. The progress of the work has been greatly handicapped by the very limited appropriations made for its maintenance. But yet, enough has been accomplished to demonstrate the fact that, with anything like adequate funds, the Station has possibilities for very large service to the people of the state. Very naturally, and especially since the funds have been low, the work thus far has been largely confined to Devils Lake itself and its immediate vicinity. And the chief end in view there has been the restocking of the lake with fish. Very extensive and most careful investigations have been made of the physical, the chemical, and the biological conditions of its waters, since such facts as these

are basic in any rational plan to restock. Thru these investigations it has been demonstrated that these conditions are favorable to the propagation of fish, provided only that the fish are acclimated before being put into the waters of the lake. And this phase of the work at the present time is in the direction of experiments in fish hatching and acclimatization.

Summer's Work at the Biological Station

The Station staff, during the season of 1914, has consisted of six men: namely, Drs. Brannon and Young, biologists; Messrs Eastgate and Moberg, assistants; Dr. Heath, chemist; and Professor Simpson, geologist. The work done has been along three lines: general scientific investigation, the hatching and acclimating of fish, and the giving of instruction.

The investigation into the composition of the various waters in and around Devils Lake and on the osmotic pressure of these waters that has been carried on for the past five years has been continued with quite definite and very satisfactory results.

The experiments in hatching and acclimating fish have also been successful. In May 100,000 pike perch eggs wree received from the Federal hatchery at Put-in-Bay, Ohio. A portion of these were supplied with aerated deep-well water, and a portion were hatched in undiluted Devils Lake water. It is interesting to note that the experiments in which the water from Devils Lake was used were much more satisfactory than those carried on with the water from the deep well. The hatching progressed very rapidly, and the fry were freer from fungi when hatched in the lake water. Thru the curtesy of Captain Main, Fish Commissioner for North Dakota, several large shipments of yellow perch of different ages and sizes were received. They were successfully passed thru the acclimatizing tanks and given to the waters of the lake.

While the teaching function of the Biological Station was not particularly emphasized at its establishment, the biological work of the summer sessions of the University has since been carried on there. The Station affords most excellent facilities for work along biological and geological lines. That fact is now coming to be appreciated, and the work of the recent summer session was very enthusiastic. Ten students were enrolled doing work for University credit, in Biology and Geology and many others, not caring for credits, were enrolled as visitors. In addition to these varied activities, the Station staff cooperated cordially with the Devils Lake Chautauqua and the Lake Side Summer School which were in session during the month of July, appearing frequently upon their lecture platforms,

and contributing much of interest to the work of those organizations. Large numbers of the Chautauqua and Summer School attendants visited the Station and became much interested in the museum and in the experiments being conducted with the fish.

In its combined service of scientific research, of attempting to contribute to the economic interests of food production, and of giving instruction, the Biological Station has made good progress during the season of 1914. Up to August first of this year Dr. Melvin A. Brannon had been the efficient Director of the Station. At that time the directorship passed to Dr. Robert T. Young, Dr. Brannon's successor as head of the Biological Department of the University.

Professor Becker's Leave of Absence The Trustees of the University have granted Professor Albert J. Becker of the College of Mechanical and Electrical Engineering a leave of absence for one year. This has been done in recognition of his long term of efficient service to the University, and in expectation of receiving even more valuable service in the years to come. Professor Becker came to the University of North Dakota in the fall of 1904 as Instructor in Mechanical Engineering. Two years later he was made Assistant Professor of the same subject, and the next year, 1907, was advanced to a full professorship of Applied Mathematics and Mechanical Drawing. During the year 1913-1914, while Dean Crouch was enjoying a leave of absence, Professor Becker served the College and the intsitution as Acting Dean.

Professor Becker graduated from the Engineering Department of the University of Michigan in 1903 with the degree of Bachelor of Science in Mechanical Engineering. In connection with his work in the University of North Dakota he continued his studies with Michigan University under absentia guidance and, in 1907, upon examination and the submission of a thesis, received the advanced degree of Mechanical Engineer. But Professor Becker has an enquiring mind, and is not satisfied with anything that stops short of relative mastery of the particular line of work engaging his attention. His studies have, therefore, been continued. He spent the summer vacation of 1912 in study at the University of Illinois, and immediately upon the close of the work here, early in June, 1914, he returned to that institution. He plans to spend the period of his leave of absence in completing the work for the doctorate. That he will make good use of his time and his opportunities no one who knows Professor Becker will doubt for a moment. He will return at the close of the year, and the University will feel well repaid for its share in the work.

Dr. Gillette in Utah and Indiana Dr. John M. Gillette of the Department of Sociology had a very interesting experience during the summer vacation, having been invited to give a course of lectures at each of two Summer Schools—the State Agricultural College at Logan, Utah, and the State University of Indiana, at Bloomington.

At the Utah Agricultural College Dr. Gillette spent two weeks, from June 22 to July 4, giving one lecture each day, discussing the general topic of Rural Sociology. His specific subjects were as follows:

I. Nature and Importance of the Rural Problem.
II. City Drift and Rural Depopulation.
III. Production and Population.
IV. Advantages and Disadvantages of Farm Life.
V-VI. Improving the Business Side of Farming Including Rural Credit Systems.
VII. Development of Rural Leadership.
VIII. Rural Recreations.
IX. Socializing the Rural Church.
X. Reorganization of the Rural School.

In addition to these he spoke, on Sunday evening, June 28, in the Mormon Tabernacle, at a union meeting of all the church congregations of the city, to approximately 2,500 people on "Current Issues." Dr. Gillette reports being most royally entertained and to having received an increased regard for the Mormon people and for the social system called Mormonism.

At the University of Indiana Dr. Gillette's work was a portion of a larger work planned by the School of Education to discuss Vocational Guidance. A six weeks' course of lectures and conferences was organized, and in carrying it out Dean W. W. Black, of the School of Education, was assisted by four educators of national reputation. Each of the four spent a week at the institution and, in a lecture and a conference each day, handled the particular phase of the larger topic in which he is authority. Dean Black's assistants were: Director Meyer Bloomfield, of the Vocational Bureau of Boston; Professor John Dewey, of Columbia University; Director William F. Book, of the State Department of Education of Indiana; and Dr. Gillette of the University of North Dakota. Dr. Gillette's work was in the third week of the course, from July 13 to 17. He discust his central subject, Vocational Education, under the following sub-topics:

1. (a) The Vocational Concept.
   (b) Criterion for the Selection of the Training Factor.

II. (a) Sociological Justification of Vocational Education .
(b) State Plans for Establishing Training in Vocations.
III. (a) Vocational Education in Relation to Special Problems in the United States.
(b) Education and the Backward Classes.
IV. (a) Vocational Education and Educational Efficiency.
(b) Organization of Subjects and Curricula.
V. (a) The Culture Element in Vocational Education.
(b) Education in Rural Groups.

The Recommendation Committee The Recommendation Committee of the University of North Dakota is the institution's agency for securing teaching and other positions for its graduates desiring employment. That is its primary aim. Another, and supplementary, object is to assist school authorities of the state in procuring competent teachers for their schools. The committee is made up of three members of the faculty—the superintendent of the Model High School and the deans of the School of Education and the College of Liberal Arts.

Thru conversations and correspondence the committee early secures information as to probable needs, in the line of teachers, in the various schools of the state. It also secures reliable data as to candidates for teaching positions. This is done thru letters of recommendation from and conference with their instructors, thru regular reports of class work, and thru personal interviews. All of this is easily done since all are upon the grounds and known personally to the different members of the committee.

Knowing the needs of both parties, and enjoying the confidence of both, the committee is in a position to serve both by selecting for the various openings that occur only candidates well fitted for them. Inasmuch as this service is performed without cost to either party and is thus seen to be wholly unselfish, both parties freely avail themselves of it. Students register, giving all needed information as to equipment and the kinds of positions desired. Boards of education apply for teachers, likewise giving all needed information as to nature of positions, subjects to be taught, salaries to be paid, and environmental conditions, and stating clearly the kinds of persons desired—equipment, characteristics, &c. The committee can then bring the two together to their mutual advantage. If the committee does not have a satisfactory candidate for a certain position that arises, it frankly says so, refusing absolutely to recommend one unsatisfactory, and the one seeking the teacher goes elsewhere. The work of the com-

mittee is not confined to students immediately present in the institution but retains on its lists former graduates who are teaching, and is often the means of securing desirable changes and promotions.

Working in this way the committee has been very successful, usually locating every available candidate and every year being obliged to send many requests for teachers elsewhere to be filled. Each year for several years it has located from sixty-five to ninety teachers. The fees for positions filled, computed at the usual teachers' agency rates, now amount to something over $3,000.00 annually, which is thus saved to the teachers.

1913-1914 Athletics at the University A brief review of the year's athletic activities at the University reveals the usual ups and downs instead of consistent victories. The success of athletic teams, however, is shown not merely in the winning of points, but as well in clean play, in working together in harmony, and in loyalty to the University. In each of these there has been progress so that the new year will open with brighter prospects.

The football season was handicapped at the start with a poorly arranged schedule and by lack of harmony between players and coaches, both facts affecting especially the early games. After the middle of the season the team settled down, playing a good game against the University of Minnesota, and defeating its old-time rival, the State Agricultural College, on its own ground.

In basket-ball the outlook was brighter; the team worked hard and showed the effects of good coaching. While their play was inconsistent, they won eight of the seventeen games, defeating the University of Minnesota on their own floor by a score of 18-16.

In baseball the season was shortened because of the lack of financial support. The University played only nine games of which she won five, losing, however, both games to Fargo College and breaking even with the Agricultural College.

Track work was started with a class meet on March 25 which was won by the class of 1917. The intra-collegiate meet on May 9 was finally won by the engineers, the meet being close and the winners undecided until the last event. On May 23 the Agricultural College was defeated 81-43, and in the Conference Meet, May 28-29, the University succeeded in getting fourth place, only two points, however, separating them from the winner of second place.

With the new Trophy Case there should be an added inspiration for University athletic teams. This case has been put in the Y. M. C. A. rooms in Budge Hall and furnishes a place for perma-

nent records of our victories. The room is open during the day and evening and students and alumni are most welcome at all times. The past records of all our athletic teams have been gone over and trophies representing their victories placed in the case. The case is large and there is plenty of room for future victories. The following is a list of the games played with scores:

FOOTBALL

September	27	University	6	Grand Forks High School	0
October	11	"	3	Hamline	14
"	15	"	0	St. Thomas	6
"	18	"	0	Carleton	61
"	20	"	0	University of Minnesota	30
November	2	"	20	Agricultural College	14

BASKETBALL

1914					
January	17	University	40	Wahpeton	13
"	24	"	20	Fargo College	29
February	6	"	47	Huron College	12
"	9	"	21	Wahpeton	25
"	10	"	31	St. Olaf	18
"	11	"	14	Carleton	18
"	12	"	11	Luther College	28
"	13	"	24	Gustavus Adolphus	21
"	17	"	18	University of Minnesota	16
"	18	"	21	St. Cloud Normal	18
"	21	"	25	North Dakota Agricultural College	30
March	9	"	24	St. Olaf	20
"	11	"	30	Fargo College	17
"	14	"	17	North Dakota Agricultural College	41

BASEBALL

May	2	University	11	Wahpeton	5
"	15	"	6	Wahpeton	4
"	16	"	5	Fargo College	9
"	18	"	2	Agricultural College	0
"	19	"	11	Moorhead Normal School	6
"	23	"	2	Fargo College	5
"	25	"	10	Agricultural College	2
"	30	"	3	St. Thomas	15
June	3	"	6	Moorhead Normal School	1

TRACK

May 23 University 81 Agricultural College 43

May 29—Conference Meet: Hamline, 45; Carleton 23; University of South Dakota, 22¼; University of North Dakota, 21; South Dakota State School, 18¼; North Dakota Agricultural College, 13.

Vacation Activities of the Faculty It is said that the student of Oxford or Cambridge does his studying during the long vacations, and something the same might be said of many faculty members if not of the undergraduates. Besides those teaching in the local summer school, a number of the University faculty taught or attended the summer schools at other universities, several carried on special work for the state and national institutions with which they are associated, and others were on the Chautauqua platform.

In a more particularly recreational way President McVey and Dean Kennedy and their families have been at their cottages in Bemidji; Dr. Abbott and family visited with relatives and friends in Indiana; Professors A. H. Taylor, Spence, F. L. Thompson and Stephenson took a three weeks' canoe trip thru the Rainy Lake region; Professor Brush made a trip to the coast over the Wonderland Trail to arouse interest in that highway, and Professor Hult spent the summer in California.

The University and its Alumni Of late years colleges and universities have been very assiduously cultivating their alumni. Some do it for one reason and others for another, but it is felt by all that a united, loyal body of alumni is one of the most powerful allies that any institution can have in any field of endeavor. The relationship should be, and often is, very close and cordial. A very interesting discussion of this relationship was given in a toast at the 1914 Commencement dinner of the University of North Dakota by William H. Greenleaf of the class of 1911. The topic is such an important one and this discussion is so sane and helpful that it is presented here in full even tho longer than and a little out of the line of our ordinary "University Notes":

Mr. Toastmaster, Ladies and Gentlemen:

History, with its amazing audacity, goes on repeating itself with none to bid it stop. Because history does repeat itself, I prophesy that the graduates of 1914 have a great joy in store for them when they return to Alma Mater. After Commencement Day the cruel world has its proverbial little fling and it cries to the gradu-

ate, whoever he is, "Be still and try to think!" But when this little joke the world delights in cracking has run its course and lost its humor, the graduate comes home to talk. And, in a world of cruelties unspeakable, the kindly University bids him speak. Yes, tho speeches fill the air with that inevitable utterance that comes in the season of birds and flowers; tho every bursting twig but symbolizes the voice of patriotism that will not lose its opportunity; tho the college ear be trained in the springtime school of experience to detect an approaching speech a long way off, yet will that ear be attentive. Experience has taught that speeches may be detected, but no power on earth can stop them. They are like Wendell Phillips,—they will be heard! Standing in a world that admits its own wisdom, in an age that hears its flatterers without a blush, the alumnus of two or three years thinks he has glimpsed the meaning of education and prepares to speak the truth. And then he senses something that bids him pause. And when he stands up in the presence of the men who are willing to hear, in place of the things he has thought for Alma Mater, of the problems he has solved for her, of all the dreams he has dreamed for her, he simply tells his love for her.

A university and its alumni are forever linked together. And the alumnus of the University of North Dakota is glad that it is so. He is glad because of pride in Alma Mater, glad because of happy memories and lasting friendships. But he sees more in the bond than this. He knows that the relationship of University and alumni is a vital thing of the present and it holds a promise of the future. In all humility I say any university needs its alumni. In all certainty I say the alumni need their university. Because of this relationship the alumni wield a power for good or ill in the life of the university. I would emphasize this fact; not to convince this University of our importance, but to accept a responsibility; not to convince the alumni of an onerous duty but to name a glorious opportunity. What I have to say has been said before, but, if it be true, repetition cannot hurt it; if it be false, much talking cannot help it. I believe that Ambassador Bryce was right when he said that the American university is the most hopeful creation of democracy. Others have been right when they have said that the salvation of democracy lies in higher education. I believe this State University is today engaged in the greatest conquest that will ever take place within the borders of the state in its larger aspects, and because of the inevitable victory Because of the practical benefit in terms of dollars and cents that the alumni can be to the state if they will, and because of the progress

of the state in its larger aspects, and because of the inevietable victory that must come thru the soul of a democracy, it gives me keen delight to say to my fellow alumni and to the graduates who tomorrow will have the opportunities of the alumni, "Is there not a cause?"

The cause of the alumni is a real one. But the task of the alumni will bring them pleasure. It is the task that made a Boston lawyer say his greatest joy came when he marched with the Harvard alumni. I used to marvel at the permanence of Yale; at the lasting qualities of the Harvard spirit. But once I saw the alumni of Yale together. Again I saw the alumni of Harvard in procession, men just out of college, men of middle-age, men whose steps were no more steady, tho their eyes were bright in that procession. And then I heard some of the graduates of fifty years ago when they spoke of the past and the present and the future of Harvard. It occurred to me then that if all the buildings of Harvard, the students, the professors, were blotted out in an instant there would spring into existence another school and it would still be Harvard. What is true of Harvard may be more true of other schools. In every great university the alumni have had something to do with the greatness and very much to do with the permanence of that greatness. What the alumni of the older institutions have seen, the alumni of the University of North Dakota may see. What the alumni of the older institutions have done the alumni of the University of North Dakota can do, and where the alumni of the older institutions have failed, the alumni of the University of North Dakota can succeed.

Perhaps the best thing a man can do for his friend is to understand him. Perhaps the best thing a man can do for two friends is to make them understand each other. We, the alumni, touch the state as friends of the state. We touch the University as friends of the University. Our noblest opportunity comes thru our two-fold relationship. As representative citizens of the state, we, like many others, are trustees of the central fact, the fundamental ideal that moves the people in its manifold development. Around this ideal must educational systems grow up that are to serve the people. A university that departs very far from this ideal will destroy its own usefulness and ultimately itself. Ours is the opportunity to bring home perpetually this central fact of our democratic state, bring it home whether the University needs it or not, keep it in the air, make it a part of general thought, write it into the minds of reasonable men. Every university, and especially every state university, needs to feel incessantly the throbbing heart of the people, to sense that hunger for real freedom which is essential to democracy. Not thru

pressure nor thru dictation may we successfully bring the feeling of the state home to the University. The spirit of dictation has no place in or around a school that is destined to be great. No man owns the University. The alumni cannot even control it. Speaking from a plane that is more concerned with lasting facts than with temporary policies the alumni cannot lessen their own opportunity by issuing commands. But they can stand their ground with that patience born of certainty and be assured that the spirit that rules the state in its best hours will rule the University. They can make clear to the University and to every institution in the state the meaning of that spirit. Moved by affection they may yet be firm, and thru the college they may serve the people.

The alumni are friends of the state but they have another friend, the University. And when one sees the alumni of a great university standing together he sees that they recognize the friendship. They strive to understand and, understanding, to make understood. There is no greater task than this. The alumni of a great university are the trustees of the central fact, of the dominating ideal of the university, just as they are of the state's ideal. They hand it down thru generations of college students, they give men coming there to school an understanding of their opportunity, but more than this, they make the central fact of the university a vital thing in the eyes of the state, so that the meaning of the university is written down in permanence. Eliot, with the help of a man or two, may have made Harvard, but the alumni kept it and the alumni have told you of it. The alumni saw the meaning of Harvard and they have written that meaning down.

What is the meaning of a university, of a state university, of our own University? What is the central fact in education in North Dakota? If we seek not this thing our service to the University will be small. I say if we seek it not, for we shall scarcely find it. We shall get glimpses of it. It is too subtle, too fine, too noble for us to see it yet. But more of understanding will bring more of service.

One man says the search for truth is this central fact. From one standpoint it is the fact, but in another sense it is not all. Yet this search is fundamental. This desire for scholarship, this willingness to grapple with large problems, this desire for research in all the fields of knowledge, is of great import. Sometimes it seems the state is slow to mesure the large ideal of progressive scholarship which has found its place in this school. It does not always sense the meaning of high standards of efficiency in study, the meaning

of the growth of research and graduate work, the meaning of the Quarterly Journal which has made for us influential friends abroad who have seen something here worth watching. Sometimes the state does not see the meaning of University Extension work which is so fundamentally vital to itself. Sometimes the really big idea which animates the University today is ignored or misinterpreted at home. But this idea forces its way beyond the borders of the state; it influences men in other schools, and it is bringing the University of North Dakota a recognition of which the state may well be proud. If the state could turn its eyes from the smaller to the larger field and see how the larger affects the smaller it would see more of the meaning of education. It would know more of the essential vitality of scholarship and more of its own great possibilities. Men outside the state have known perhaps better than we have known that there came to us a few years ago a call to a new field, a summons to meet new forces in the educational world, and they have seen, be it said to our honor, that there were men here who dared to seize the opportunity, men who have placed us upon the basis of educational progress. If men abroad have seen this fact, the state may see it. We can know it. We can make it known.

I have implied that the central fact that the alumni ought to seek is not wholly a search for truth. The most vital thing in a man is his personality, or, from another standpoint, his character, if you will. So it is with a university. Character has been defined as "point of view" and I like the definition. Nothing tells so much of a man as that brief conversation that discloses his point of view, so nothing tells so much about a university with relation to its greatness as its point of view. The personality, the character, the point of view, the atmosphere of a college, are the most vital things. A university whose catalog shows an absolutely efficient management, a faculty with high degrees, may yet be no great university. The call that Emerson gave to the college to create rather than to drill is still heard and heeded by our great universities. Efficiency is excellent, but a mere machine has no inspiration, no heart, no use except a hand be there to guide it. The subtle something which is so powerful in a college and which I shall not presume to define, is a thing closely allied to the finer imaginations of men, making a scientist link his work with larger fields, making the engineer see himself in relation to an expanding society, making the lawyer see the relation of law to justice, and making all men see the relation of individual personality to a world of endless social achievement. There are universities that turn out classes. Great universities must turn

out men. What of it that no microscope can disclose the secret? What of it that the psychologist or the sociologist may not give you explanations? For us the fact is sufficient that the university with no distinctive point of view, no personality, no individual character, is not the great university.

If this mark of the great university is not to be wholly defined, is there a test for locating it? What college has it? What college has it not? It comes where great teachers are. It is never found where competition has driven them out. The greatest thing a university can do is to teach. The greatest teacher in a democracy is he whose students see themselves, students who have faith in the society around them but who can deny the clamor of that society if they should, men who are not lost in that semi-materialism that has taken its last stand in a social reform that knows classes but not men. Of all the things a democracy needs she needs individual men the most. Without them she will fail, and no social reform, no legal enactment, will protect her. If there be a university whose teachers send out the common citizens of a state imbued with the fire that accomplishes things and moves with power, the greatest battle of a democratic state will have been fought. Business will reflect it, science will note it, and the dream of poets will be true.

As alumni of the University we may act. We may understand the central fact of the University, the meaning of the University in its relation to the state as well as the meaning of the state itself, and we may make these meanings clear. As the University cannot afford to misunderstand the state, so the state cannot afford to misunderstand the University. Every walk of life needs the University. Every line of activity needs it. It is here to live in the life of the state. I believe that it is here to win its conquest. As alumni, standing together, we can move mountains of misapprehension. Standing together, we can thrill the state with the enthusiasm of education. Standing together, we shall see our opportunity and, standing together, we cannot fail.

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Announcement

THE Quarterly Journal is a periodical maintained by the University of North Dakota. Its primary function is to represent the varied activities of the several colleges and departments of the University, tho contributions from other sources are welcomed when they are the fruitage of scientific research, literary investigation, or other form of constructive thought. Correspondence is solicited.

All communications should be addrest,

THE QUARTERLY JOURNAL,
University, North Dakota.

Editor's Bulletin Board

SOME of the articles Mentioned in the Bulletin Board of the October number as likely to appear in this have been forced aside by others more immediately urgent. They may be expected in the issue for July, 1915.

The next number, that for April, 1915, will be given over to the natural and physical sciences. That it will be an interesting and valuable number will be seen by a mere reading of the titles of some of the articles promised: "State Inspection of Petroleum Products"; "Some Chemical Phenomena in Photography"; "The Audion as a Heterodyne Receiver"; "Unnecessary Use of Verniers"; "A Further Study of Riemann's Surfaces"; "Physiology of Digestion," and "The Mosquito Problem and its Solution."

The University of North Dakota

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The Quarterly Journal

VOLUME 5 JANUARY, 1915 NUMBER 2

The Work of the North Dakota Tax Commission

LUTHER E. BIRDZELL,

Professor of Law, University of North Dakota

(*Chairman North Dakota Tax Commission. Resigned, Oct.*, 1914)

A DISCUSSION of the work of the North Dakota Tax Commission involves the consideration of four questions: first, what is the Tax Commission? second, what called it into existence? third, what power has it? and fourth, how has that power been exercised? The first question is adequately replied to by the mere statement of a definition. The Tax Commission is a department of the state government in which is vested a general administrative authority over matters of taxation, to which is added a limited amount of quasi-judicial power. The Commission is composed of three members chosen from at least two political parties, one member being appointed every two years. The tenure is thus arranged with a view to insuring against frequent sudden changes in administrative policies that touch vital matters of universal interest and to prevent policies and changes being dictated by considerations of political expediency.

In presenting the condition which called the Tax Commission into existence reference may properly be made to a general situation which has given rise to new demands upon governments, both state and national, as well as to the local condition regarding matters of state and local finance. First, with regard to the general situation, it is noteworthy that the most pronounced tendency in all efforts to improve the taxing systems of the various states in recent years is toward the correction of the administrative machinery for applying the laws governing taxation. This is no doubt one of the results of the changes in the industrial organization of society which have brought about a large mesure of centralization in the control of industry. It has been found necessary for government to keep pace with the industrial organization and it is now quite generally

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recognized that the demands of efficiency require an adequate central machinery for administering a complicated revenue system. If the securing of justice at all times to and between the state, the corporation, and the individual in their various relations with each other is an objective, *laissez faire* must give way to a new individualism that gives strength to the arm of the government sufficient to enable it to cope with the new demands made upon it.

So general has been the recognition of these new demands that three-fourths of the states in the union have within the last fifteen years provided a more efficient system of tax administration. In some twenty-seven states the improvement has taken the form of the creation of tax commissions. Having thus briefly considered a general condition and a general tendency, it remains to inquire what local conditions lent force to the call for a tax commission in North Dakota. That there existed a general sentiment favorable to the creation of such a commission is evidenced by resolutions of the State Tax Association, by planks in the platforms of the political parties, and by messages of the Governor to the Legislature. A brief survey of the revenue system of North Dakota in operation will reveal an adequate foundation for the prevailing sentiment.

North Dakota, like her sister states of the West and Middle West, has relied almost exclusively upon an ad valorem tax to secure revenue for state, county, and local purposes. Prior to 1913, no provision had been made to offset the constantly decreasing revenues from intangible property incident to the growing practise of exempting such property from taxation under the uniform ad valorem system. The general property tax system of the state had practically broken down. It had not only failed in every particular to meet the expectations of its earlier advocates that it would effect an equitable distribution of the tax burden, but it had as signally failed in producing revenues adequate to meet the ordinary requirements. Perhaps the failure in the latter respect, however, was due more directly to the fact that the whole system had become circumscribed by legislative restrictions predicated upon a perpetual violation of the fundamental principles upon which the structure was built. Laws had been passed under which taxes were levied, debt limits fixed, and salaries of public officers determined, all upon the apparent assumption that the requirements of the constitution in the matter of assessment and valuation would be perpetually ignored.

While other states were successfully meeting the condition incident to the failure of the general property tax by adopting laws providing for uniform taxation at low rates of various forms of intan-

gible property and inheritance tax laws, and were deriving large amounts of revenue from license taxes of various sorts, North Dakota was struggling along with a general property tax which existed in reality only upon the statute books, being honored more in a systematic departure from its rigid requirements than in an attempted observance of them. The extent of the failure of our laws to reach the intangible taxable property will be very apparent from the statement that the assessment of all credits, monies, stocks of foreign and domestic corporations (excluding banks), royalties, annuities, franchises (excluding railroad, express, telephone and telegraph) was in 1911 less than $800,000.00. The inadequacy of the laws designed to compensate for the deficiencies of the general property tax is apparent when it is known that the collateral inheritance tax law in ten years had produced less than two thousand dollars in revenue; that aside from the usual provisions for licensing foreign insurance corporations the only law requiring licenses of foreign corporations imposed but a nominal annual charge of $2.50, and that these represented the whole effort of the state in this direction.

The clearest demonstration of the deplorable condition into which the taxing system of North Dakota had lapsed is afforded by the resultant condition of the public finances which has but recently been exhibited. Tho the ratio of the state tax to local taxes had constantly decreased since statehood from seventeen and sixteen hundredths per cent. in 1890 to ten and fifty-nine hundredths per cent. in 1913, and tho the per capita state tax had also declined from two dollars and thirty cents in 1890 to two dollars and six cents in 1913, it was found impossible to levy sufficient taxes to maintain the state institutions on an economical scale and to meet the demands of conservative appropriations without seriously disarranging county and local finances. As a consequence revenues which are necessary to support the activities of a state government resting upon a citizenship which prides itself upon its public spiritedness are reduced more than thirty-eight per cent. Thus has the lack of a balanced correlation brought us to a crisis in our public finance.

Wholly apart from the condition above set forth, but yet allied with it and having its origin in the prime source of disregard of legal requirements, was the condition of inequality arising from the lack of uniform rules and procedure. In North Dakota the making of an annual assessment involves the exercise of important official acts by more than six thousand officers. Without proper organization and provision for working to a common purpose there is sure

to be much variation in the handling of similar problems and much consequent inequality. Of these officers by far the most important is the local assessor, and the independence of this official has become almost proverbial. How often have we heard the statement "Every assessor is a law unto himself." Independence in a public official is desirable but when that indepednence comes to be a cloak that shields erroneous practises it is well that some of it be sacrificed in the interest of efficiency, uniformity, and justice.

When the assessment is completed, a foundation is irrevocably laid that determines the distribution of burden among those required to contribute to the support of the various governments within the state. The aggregate annual enforced contribution is approximately thirteen million dollars. Exprest in another way, a judgment is entered against the tax payers in an amount equivalent to nineteen dollars and fifty cents for every man, woman, and child. Both the importance of the task involved and the necessity of the application of common sense methods of organization have no doubt contributed in a mesure to a recognition of the need of administrative reforms. Thus was the field marked out for the labors of the Tax Commission, and it is now pertinent to consider what power was given the Commission to enable it to pursue a course that would bring results.

The powers and duties of the Commission may be considered under two heads: advisory and administrative. In its advisory capacity it is called upon to confer with the Governor and the State Board of Equalization and to make recommendations to the Legislature. In its administrative capacity the Commission is called upon to make original assessments of light, heat and power companies, subject escaped property to taxation, administer the inheritance tax law, issue instructions to assessors, boards of review and equalization and to supervise and direct the work of these officers, to review the same and order reassessments, to conduct investigations to ascertain the working of the revenue laws, and to gather and compile statistics upon the cost of government and the distribution of the burden of taxation. It will be seen that the activities of the Commission may properly cover a wide range and that the field is one of much potential value to the public. There remains for consideration the work of the Commission during the period since its organization—now a little more than two years.

Altho the Commission had existed but six months prior to the convening of the Thirteenth Legislative Assembly, it had gathered much material bearing upon the working of the revenue laws. From

this it seemed apparent that a number of changes were desirable. The results of its investigations and its recommendations were submitted to the legislature in the form of a special report. In addition to this the Commission prepared a series of bills designed to carry out its more important recommendations. While a detailed analysis of the various recommendations and bills would carry us beyond the proper limitations of this general article, it is necessary to point out the general nature of the various specific mesures.

Perhaps the most important bill was the one providing for the substitution of the county assessor system for the local assessor system. This bill was obviously in the interest of better and more efficient administration. It preserved what is valuable in local autonomy by providing for the selection of a county assessor within each county. It aimed to secure uniformity of action thruout a county by making deputies responsible to the county assessor and by having within the county one responsible head who would be familiar with the entire assessment. It tended to secure efficiency by reducing the number of officers, by centering responsibility, by simplifying organization, and by creating a natural repository for all valuable information relating to taxation. It also furnished a laboratory for working out the details of various methods, such as assessment maps, etc. The bill passed the Senate but failed in the House by a narrow margin.

Another proposal was an inheritance tax law that would reach direct or lineal inheritance as well as collateral inheritance. Only the latter were taxable under the then existing law and the law was so framed as to be practically worthless as a revenue producer. This bill also failed of passage but only because of the fact that it came into competition with another bill embodying the same principles which gained a right of way for passage. Under the bill which became a law, the duties of administration devolve upon the Tax Commission. The proceeds of this mesure already far surpass the returns from the former law in the ten years of its operation, and the taxes upon taxable inheritances passing during the first year of the operation of the law approximate forty-five thousand dollars. Much can be expected from this source in the future.

The remaining bills recommended by the commission are of passing interest only. One was designed to forestall the financial embarrassment that was impending by reason of the statutory straight jacket into which the public finances were rapidly being forced. This it did by providing for a continuation of the existing status with regard to fixed special levies, salaries of county officers, and debt

limits of municipalities in case it should be found advisable to increase the assessed valuation by raising the basic percentage. Another was designed to correct an unconstitutional law governing the assessment of "corporate excess." Another amended the provisions governing the assessment of bank stock, and still another authorized changes in the items of personalty making up the assessment schedule. This entire group of bills received favorable action in the Legislature, but the potency of the executive veto prevented their enactment. In view of the general unsatisfactory experience of tax commissions in other states, the North Dakota Commission felt gratified at the result of its labors in a capacity advisory to the Legislature.

The work in this field is of a continuous character. Since the adjournment of the legislaure in 1913 the constitution has been amended in such a way as to give rise to new problems, or, rather, to admit of new solutions of old problems. The constitution no longer requires a uniform advalorem assessment, but, on the contrary, it admits of classification of property for purposes of taxation. The Commission has given special attention to the problems incident to this change and in its forthcoming biennial report will recommend mesures designed to improve the method of taxing intangible property. It is not possible within the limits of an article of this character to consider in detail mesures that will be offered for consideration of the legislature, but suffice it to say, that the mesures will be those having back of them some years of successful operation in various states, and the Commission has every confidence that its recommendations upon this subject will be followed to the great betterment of the tax system of the state. The Commission repeats its recommendations of two years ago and fortifies them with two years of experience which have all the more clearly indicated the necessity for the changes sought.

In the performance of its duties to act in advisory capacity to the Board of Equalization, the Commission has found itself at a disadvantage. Being without a vote on the Board of Equalization, it has been able to accomplish but little in this field. Perhaps little should be expected when it is considered that those who must be held accountable for the work of the Board of Equalization have little opportunity to familiarize themselves with the merits of proposals coming from an external source. In as much as the time of the board is largely taken up by listening to arguments in support of the demands of those directly interested in its action, it is hardly to be expected that the board would be in position to depart greatly from established practise. In the states that have made the most

progress in taxation in recent years, notably Minnesota, Wisconsin, Kansas, and South Dakota, the ex-officio boards of equalization have been superseded by the tax commissions and it may well be that North Dakota can profit by this experience. It is certain that divided responsibility is as productive of demoralization here as elsewhere. The very responsible work of equalizing values of property and of making original assessments of large public service properties demands that much time be spent investigating the varied sources from which must come the information bearing upon values. It is hardly fair to a public officer elected largely because of his fitness to perform other duties to require him to assess annually, without time for previous preparation, more than $225,000,000.00 worth of property, and to equalize the assessment of a billion dollars' worth in addition, and to do all this within the very limited time alloted to the sessions of the Board of Equalization.

The administrative work of the Commission has been on the whole quite satisfactory when it is considered that the Commission has not exercised final authority in the state equalization. In making original assessments of light, heat, and power companies, the Commission in its first experience saw the necessity of obtaining more complete knowledge of the facts upon which the assessments are based. In view of the impossibility of gathering the facts for the first assessment made by the Commission in 1913, there was no disposition to depart materially from assessments made prior to that time by the local authorities, and these assessments were not departed from except where inequality was manifest. During the interim between the 1913 and 1914 assessments of light, heat, and power companies, however, the commission obtained an engineer's appraisal of all the light, heat and power companies of the state, and it is believed that the assessment of 1914, which was based largely on this appraisal, is the most equal assessment of this class of property that has been made and it is at the same time a much larger assessment than has been made in the past.

We are accustomed to mesuring the value of every new public agency by the consideration of cost compared to returns, and asking if it pays. This question is often asked concerning the work of the Tax Commission, and, without conceding the propriety of a test that does not look beyond financial returns alone, it may not be improper to give at least partial answer to the query. Without attempting a detailed statement of results in dollars and cents, mention may be made of one of the principal activities of the Commission tending directly to lighten the general burden of taxation. The

Commission found that a provision of the Constitution requiring the assessment of sites upon the rights of way of railroads within the state had, with rare exceptions, been ignored thruout the state. It undertook to cause assessments to be placed upon these properties for the period of six years. As a result of this work there is on the tax lists of North Dakota in the year 1914, an assessed valuation of approximately $5,000,000.00 distributed over several thousand leased sites upon the railroad rights of way. The proper doing of this work constituted a task of no mean proportions

Among other administrative results well worth while is the securing of a uniform assessment of the stock of the seven hundred fifty banks of the state, thus correcting many extreme inequalities. This was done thru an exercise of the powers of review. Like results can be attained for other classes of property as occasion arises and facilities are afforded. Mention might be made of other specific matters and of minor problems affecting smaller groups of individuals and communities, but enough has already been set forth to convey a fairly adequate idea of the activities of the commission.

In view of the newness of the Commission as a department of the state government there is a general disposition to treat it as on trial. It has not been the writer's purpose to justify. He has been content, rather, with an endeavor to present the field in which the Commission has labored and to show some of the work and the results. If he has succeeded mesurably well in doing this, this article has served the purpose for which it was designed.

That the work of the past may be turned to the greatest advantage in the future in handling the more important matters with which we are soon to deal in this state should be the hope of every public-spirited citizen. It is believed that the importance of these problems is seldom fully appreciated. We are growing and developing apace and there is perhaps no state in the union that insists more earnestly on making adequate provision for the highest social and economic development. While thus exalting the welfare of the citizen and adhering to a high ideal in government, we must be prepared to meet and solve our problems of taxation. Whatever may be the trend of tax reform in this state we must be prepared not only to meet the various problems on the administrative side, but we must deal with vital facts more upon a basis of knowledge and less upon a basis of speculation. The Tax Commission is equipt to render valuable aid in both directions and the part that is will take in this work should and doubtless will be a most important one.

Statute Law Making With Suggestions to Draftsmen

SVEINBJORN JOHNSON,

Instructor in Economics and Political Science,
University of North Dakota

INTRODUCTION

IT is said that ours is a government of law, not of men. Does anybody challenge this statement? If so, we produce the two bulky volumes of our Compiled Laws, just published by the Lawyers Co-operative Company, containing over three thousand pages, and eleven thousand four hundred thirty-eight sections; mark them Exhibits "A" and "B" and rest our case. In less than ten years our statutes, with the construction put upon them by the Courts, have doubled in bulk, and every session of the legislature grinds out about four hundred pages of new laws and amendments. In view of these facts it can not be amiss to inquire how these laws are made. Our purpose, however, is neither criticism nor commendation, but we are, as citizens, impelled by a sense of obligation, a feeling of interest, that we should know something about the essential features of our law-making machinery.

It has become fashionable in these times to reproach the average state legislature with inefficiency, or worse. That honest men tremble while it is in session or that no man's property is safe until it has adjourned, and a host of other observations of like import, have, because of age and frequent repetition, long since lost their appeal to our sense of humor. But with the frivolous has also been much serious criticism, and the suggestion has been made by Governor Hodges of Kansas, and others, that the legislature, as now constituted, be abolished and a small body of experts be substituted for it.

In the following pages, however, it will be assumed that our institutions as they now exist in North Dakota will not soon be fundamentally changed. We shall, therefore, take conditions as they are and endeavor to ascertain what defects, if any there be, are merely superficial, and which are fundamental, and perhaps venture to suggest how some of the former may be removed and the consequences of the latter partly avoided.

The subject expresst in the title of this article will be dealt with from two points of view, or, rather, it will be divided into two

general divisions, the first, "The Ethical Aspect of Law-making," and the second, "The Technical and Precedural Processes of Law-making." By the former reference is had to the subject matter, the content of the law; by the latter, to the form, the language, the method of statement of the law, with some observations on procedure in the legislature.

The state legislature is one of the three co-ordinate branches of the government. To it is entrusted the important duty of making the law; to the judicial department has been delegated the power to construe the law; and to the executive, the duty of enforcing it. Without making any comparison with respect to the relative importance of the three departments of state, it goes without saying that the legislative branch has a very important duty to perform. To emphasize this idea it is sufficient to call attention to the fact that the state supports, at great expense, an army of administrative and executive officers whose duty it is to carry out, to apply to the affairs of daily life, the laws passed by the legislative assembly. It maintains, likewise at great expense, a series of courts, about one-half of the time of which is consumed in construing statutes. An examination of the reports of the supreme courts of this country discloses the interesting fact that from one-third to one-half of the space in the volumes reporting their decisions is devoted to cases involving the construction of statutes.

That statutes are multiplying with alarming rapidity is apparent on examination of the codes and statutes of the states of the Union. The statutes of New York State, as compiled, are now embraced within about a dozen large volumes. Every year adds to this mass of statutory law. Every year the New York Legislature adds two volumes to its statutes, and what is true of New York and North Daokta is likewise true of every other state in the Union. During the years 1909-1913 the legislatures of this country passed over 62,000 statutes, a library of about one hundred twenty-five volumes.

Back of every law, as a cause for its existence, is a real or imaginary grievance. Having discovered the evil to be remedied, the lawmaker is confronted with two profoundly important questions; first, what shall be his method of treatment, what should the policy of this state be in dealing with the evil he has discovered, and secondly, having settled upon the method or the policy, how is he equipped, what means has he at hand for the difficult task of reducing his thoughts and his conclusions to writing in the technical form of a legislative bill?

Having thus, in a very general way, stated the problem that confronts the lawmaker, let us briefly examine his equipment and his qualifications. The House of Representatives of the 13th Legislative Assembly consisted of one hundred eleven and the Senate of fifty men. Of these one hundred eleven in the House, twelve were lawyers and one was a physician. The others, numbering nearly one hundred, were farmers and business men, two-thirds of them without any previous legislative experience or acquaintance with any branch of the public service. These farmers, business men, and lawyers when they became candidates for the legislature were actuated by various motives, but with all of them or most of them, the business of law-making was a secondary consideration. Some of them, no doubt, hoped that the legislative office might be a stepping-stone to some form of political advancement; others, again, thought that service in the legislature conferred honor and prestige worth the sacrifice of two months of time to attain. But whatever the motive, the fact remains that the vast majority of our lawmakers approach their work without any previous preparation or training, indeed, with but a faint appreciation of the difficulties of the task that awaits them.

Before proceeding to the next topic, the writer cannot refrain from recording a conclusion to which he has come after some examination of the statutes of other states as well as of those of North Dakota. From the standpoint of context, form, and technical construction, it appears to him that the laws of our state compare favorably with those of many states, and that they do not suffer by comparison with those of any state in the Union, with the possible exception of Wisconsin. Nothing has ever been found in our statute so unique as this from the code of a western state: "When two trains meet at a crossing they shall both come to a full stop and neither shall start up until the other has passed over." Whether the problem here presented is one of statics or of simple logic it is unnecessary to decide, but it would probably tax the ingenuity of the most resourceful coure in the land to interpret this statute literally and bring the trains in on schedule time. Nor do we have any statute on our books so punitory in character as that of another state which requires that no druggist shall sell any patented medicine without first tasting it himself. While the courts do not inquire into the motives of lawmakers, the layman will be inclined to think this rather severe treatment of a necessary class of tradesmen.

This merit of our law, if merit it be, is entirely comparative. It is probably true, at least the statement has attained almost uni-

versal currency, that, in form and structure, statute law in the United States is crude and lacks most of the essentials of an ideal law, and that it suffers seriously by comparison with statute law of England and other European countries. That the careful and learned member of the English Parliament occasionally lapses into carelessness and loose expression, appears in the 53d statute of Geo. III, Chapter 146, in which the penalties under the act were to be given one-half to the informer nad one-half to the poor of the parish. The only penalty imposed, however, was transportation for fourteen years. Again, an amendment proposed by the Queen's Counsel in 1865 reads as follows: "Every dog found trespassing on enclosed land unaccompanied by the registered owner of such dog, who shall upon being asked give true name and address, may be then and there destroyed by such occupier by his orders."

Nor is the following, from the Agricultural Holdings Bill during the committee stage in the House of Lords, entirely free from obscurity: "To ask the Government whether they will consider the practicability of introducing into the bill some provision for alleviating the great hardship now suffered by the family of any clergyman if he dies while occupying his glebe, as many clergymen have lately found themselves compelled to do."

In passing it should be pointed out that the Parliament of Great Britain has, during the past forty years, been assisted, in fact, almost directed, in the technical work of drafting bills, by expert draftsmen under the control and supervision of an official who is known as Parliamentary Counsel. This, of course, explains the clearness of English statutes.

The Ethical Aspect of Lawmaking

With the development of industry and the increasing complexities of social and industrial life, the task of the lawmaker has grown increasingly difficult. Up to within recent years the legislature in all our states was the same in form and structure as that of one hundred years ago. Since the formation of our state and national governments, individual producers have united in the partnership; the partnership form of business organization has developed into the corporation, and from the corporation have risen such forms as the holding company and other devices of the combination movement. With the growth of large scale production and of transportation facilities came concentration of population in cities, and with the growth of cities, in turn, appeared a multitude of problems requiring solution. But, notwithstanding these changes in industry,

and the almost fundamental changes in the relations of individuals to one another, the legislative machinery dealing with all the problems to which these changing conditions have given rise, has remained unaltered.

STATE LIBRARY COMMISSION

Every session furnished additional proof of the incompetence of the average state legislature to cope with the problems which in complexity and numbers multiplied space. Since the legislative tasks increased in scope and grew rapidly more difficult, something had to be done to equip more fully the lawmakers for the performance of their ever expanding duties. Following the lead of half a dozen states, North Dakota, in 1907, created a State Library Commission. This commission did not organize until more than a year after its creation. The duties of the commission, as prescribed by law, were three-fold: first, to build up and maintain a system of circulating libraries, collections of 45 to 50 books packed in small wooden boxes to be loaned to school districts and communities free of charge except for transportation; second, to maintain in the capitol at Bismarck an educational reference library, also free to the people of the state except for the cost of transportation, and third, to establish and maintain

A Legislative Reference Bureau

in charge of a legislative librarian whose duty it was and now is to gather, classify, and condense information upon all questions before the legislature and to assist members of the state legislature in the preparation of legislative bills.

The creation of the Legislative Reference Bureau was the first recognition in North Dakota of the necessity of providing some assistance to the lawmakers in their work. After criticising the legislator for inefficiency and pointing at him the finger of scorn and suspicion, it dawned upon the more conservative critics that perhaps the lawmaker had been as efficient as the system permitted him or made it possible for him to be. A little thought on the part of students of political science disclosed the startling fact that while the Supreme Court, whose duty it is to construe the law as made by the legislature, was supplied with thousands of volumes for reference and guidance in arriving at its decisions, the lawmakers themselves were entirely unaided in the difficult task of making the law. Partial explanation of the great amount of time consumed by the supreme court in construing obscure and carelessly drafted statutes

was at once found in the fact that the draftsmen, the lawmakers—farmers, business men, and lawyers—not only had had no training for their work, but had absolutely no information or reference material at their command during the legislative session. Having realized this condition of affairs, state after state took steps to remedy the situation; instead of sending unintelligible statutes to the courts for construction, these states decided to improve the product. It appeared wiser to build a fence around the edge of the precipice than to provide an ambulance at its base. It seemed the sounder economy to improve the quality of the statutes rather than to multiply judges for the purpose of straightening our statutory tangles.

Altho the legislative reference bureau is of comparatively recent origin in America, its basic idea is almost as old as our civilization. Many centuries ago some students under the direction of their great master, Aristotle, made a comparative compilation of the customs and the constitutions of Grecian cities. We cannot but feel that this excursion into the field of comparative politics must be alike accepted as proof of his sagacity as a student of politics and as in part accounting for the pre-eminent position his writings have since occupied. Aristotle did what the legislative reference bureau of today aims to do; namely, to seize the accumulated political experience of the past and make of it a lamp to guide the state thru the complicated problems of the present.

The work of the legislative reference bureau at Bismarck, and the valuable service it now renders and can render to the state if reasonable provision is made for its maintenance, cannot be adequately described in this article. The merest outline must suffice. Between sessions, as well as during sessions, the legislative librarian collects information on subjects that are likely to come up for consideration when the legislature convenes. This information consists of pamphlets prepared by students of and specialists in each subject; of reports of commissions, of investigating committees, bureaus, and other bodies, that have conducted inquiries in specialized fields; of the reports of departments of state and municipal governments that have had charge of the enforcement and administration of laws dealing with specified subjects; and of discussions from the current newspapers including comment on the law as it works in actual application to the conditions of life. The material thus gathered is carefully classified and condensed and is then ready, in convenient form, for use by the busy lawmaker. The lawmaker has no time to wade thru the volumes of reports and pamphlets and books that exist dealing with the subject in which he is interested. The mate-

rial must be condensed and digested for him, and this is the task of the legislative librarian.

The bane of American lawmaking has been imitation. It is easy to find a law in the statute books of some state more or less remotely touching the subject in which a legislator happens to be interested at a particular time. This law being found, the impulse is well nigh irresistible to copy it verbatim and introduce it as a legislative bill. This course is easy. It involves the minimum of mental exertion and at the same time arms the father of the bill with the argument, strangely impressive upon the average man, that the bill is already a law in some state of the Union. In this manner absurd, obsolete, and even repealed laws have been copied by one state after another. The law is taken for better or worse and for the worse it too frequently turns out to be.

Entirely unmindful of the fact that a law is framed—theoretically, at least—to meet specific economic conditions, the average legislator copies the old law in the hope that in some mysterious way it will fit other, and, it may be, fundamentally different circumstances. This legislative tailor takes a garment made for a man five foot five and, without alteration or reconstruction, tries to put a fellow six foot six into it. The result is as disastrous to the garment as it is embarrassing to the victim. The legislative reference librarian is not satisfied with this ready made style of legislation. He ascertains the conditions that occasioned the enactment of the law; he seeks to discover how efficaciously the law met these conditions; he compares the local conditions with those for which the law was originally framed; and lastly, he culls the virtues, if any there be, from the borrowed law, rewrites it, and adapts it to the needs of his own state. This is the only safe use that can be made of the laws of other states, but the lawmaker without the reference library is helpless. He can only copy, only imitate, and his copy will be a faithful likeness of the vices and the virtues of the model.

The legislative reference library is an impartial, non-partisan bureau of information. Its sole purpose is to gather together the facts on both sides of a question and to present these to the men making the law. In 1910 this department, in response to a demand for this information from lawmakers of the session of 1909 and from the public, prepared a compilation of laws creating State Tax Commissions in this country. In this bulletin were published, in comparative form, digests of the laws of all the states had created Tax Commissions. In this digest, which was printed and sent to all the members of the legislature, was a vast amount of information

from every state having a tax commission, showing the results of actual experience in each state. In cases where the laws had been construed by the supreme court the opinion of the court was cited and, in some cases, quoted whenever deemed essential to a correct understanding of the law. The result was that when the legislature convened in 1911, the legislative reference department was prepared to furnish, and did furnish, facts and information on both sides of the question of establishing a State Tax Commission in North Dakota.

In the same manner other topics have been dealt with and information subsequently gathered and, when possible, printed for the convenience of the legislator, like, for example, Good Roads, Widows' Pensions, Uniform Accounting, etc. The legislative library, therefore, has become an important adjunct to the state legislature. It is there that any member can get reliable information upon any subject that may be before him, with the assurance that the service is non-partisan and unbiased. That there is now collected and classified and condensed in convenient form in this library at Bismarck more information upon public questions than in any other place, or in all other places combined, in the state of North Dakota, there is no question.

It is also clear that the state has not yet learned to make use of this bureau to the extent to which the resources it commands justify. One instance from our legislative history is sufficient to establish the correctness of this conclusion. In 1911 our legislature appropriated $1,000.00 for the purpose of collecting information on the question of workmen's compensation. A committee of three men was appointed. They made a report which consists almost entirely of quotations and extracts from the reports of compensation commissions of other states, to which were appended two proposed bills. This report, which was printed, cost the state about $1,000.00. All the material in that report, all the information it contained, and very much more, was available in the reference library. Every report of every commission quoted or cited in the report of this committee was and is now found in the reference library, and the compilation could have been made by the legislative librarian with the assistance of a stenographer, in less than two months' time and at an additional expense to the state not exceeding $100.00. By the above illustration no criticism is intended upon the work of this committee; the members of that committee did as well as the funds at their command permitted, but the point is that the state, by using an agency already in existence, could have attained the same result at almost no addi-

tional cost, and the $1,000.00 expended by the committee could have been devoted to some other and more useful purpose.

No one familiar with the work and organization of these departments in this country will doubt that the legislative reference bureau could be and should be made an invaluable aid to the state both between and during sessions. With a comparatively small appropriation for its maintenance, it can, in co-operation with intersession legislative committees, conduct investigations into some of the problems that our lawmakers are biennially called upon to consider. The material gathered between sessions could be digested and condensed into the form of a report, of course always in co-operation with committees of the legislature last sitting, and then submitted to the next legislature for consideration. In this day when efficiency and economy seem to be, as they should, the watchwords of public officials, the legislative reference bureau could be utilized to take the place of, or at least, to co-operate with, expensive investigating committees or commissions.

Better than any other man in the state, the legislative librarian knows what other states are doing and what the world is doing in every field of public endeavor; he has all the sources of information at his command; he knows *where* the material on any subject can be found, and he can obtain it at only nominal cost; much of it he has already collected, but what he has not gathered he can easily get; he is a specialist, the only specialist of his kind in North Dakota; his maxim specialist, the only specialist of his kind in North Dakota; his maxim is the motto which every teacher should adopt and every student embrace, *"Scire, ubi aliquid invenias magna pars eruditionis est";* he is the only man whose specialty it is to know *where* information can be found and then to be ready to supply it. To neglect to make use of this agency when investigations must be made—no important law should be enacted without previous investigation—can mean but one of two things, an inadequate appreciation of the possibilities of the bureau, or a desire to make pie of the kind that politicians dream about.

The Technical Processes of Lawmaking

This division of the subject naturally falls into two parts; the preparation of the legislative bill and the processes by which it becomes a law. The one concerns itself with the reduction of the ideas of the lawmaker to writing in the form of a proposed law, the other with the legislative organization, with its rules, its system of work, its business and deliberative efficiency.

THE DRAFTING OF BILLS

At the outset something should be said about the preparation and equipment of members of our legislature for their duties as draftsmen. As has been pointed out, most of them come from the farm, from the office or the work shop, three-fourths of them without practical experience of any kind and almost all of them without any expert training in the work of bill drafting.

Lest I be understood, however, as belittling unduly the training and ability of our lawmakers, I call attention to the following expressions of opinion, the first being from the report of a committee of the American Bar Association, appointed in 1912 to consider and report upon the subject of legislative drafting. This committee made its report at the Montreal meeting, in 1913. Speaking of the qualifications of the lawyer as a draftsman—the lawyer is popularly supposed to be especially qualified for the difficult task of lawmaking —the committee says, among other things, "But the average lawyer of experience is very far from being a trained draftsman, and bills prepared by commissions, while usually a great improvement on bills introduced by members on their own initiative, are by no means free from faults of form and graver faults of confusion and obscurity of expression, all of which could have been easily avoided, if, in addition to special expert service, the body responsible for the bill had at their disposal the services of a trained draftsman. and had availed themselves of such services."

Speaking before the American Bar Association, in 1908, at Seattle, Judge Scofield says, "To draw a statute modifying the common law in such language as to effect exactly the result intended in one of the most difficult achievements of legal skill."

John Stuart Mill, in his "Representative Government" says, "There is hardly any kind of intellectual work which so much needs to be done, not only by experienced annd exercised minds, but by minds trained to the task through long and laborious study, as the business of lawmaking."

Judge Cooley, in his "Constitutional Limitations," says, "The deficiencies of human language are such that if written instruments were always prepared carefully by persons skilled in the use of words, we should still expect to find their meaning often drawn in question, or, at least, to meet with difficulties in their practical application. But, when draftsmen are careless and incompetent these difficulties are greatly increased; and they multiply rapidly when the instruments are to be applied, not only to the subjects directly within

contemplation of those who formed them, but also to a great variety of circumstances which could not have been anticipated, but which must, nevertheless, be governed by the general rules which the instruments establish."

In considering the qualifications of the average lawmaker for the technical work of drafting a bill we naturally inquire what are the difficulties of the task before him? Ordinarily it is difficult enough for the average man to express himself clearly and concisely but that the difficulties of the lawmaker are more serious than those of the ordinary writer appears from the following from Mr. Justice Stephen; "I think that my late friend, Mr. Mill, made a mistake upon the subject, probably because he was not accustomed to use language with that degree of precision which is essential to every one who has ever had, as I have had on many occasions, to draft acts of Parliament, which, although they may be easy to understand, people continually *try to misunderstand*,* and in which, therefore, it is not enough to attain to a degree of precision which a person reading in good faith can understand; but it is necessary to attain, if possible, to a degree of precision which a person reading in bad faith cannot misunderstand. It is all the better if he cannot pretend to misunderstand it." In other words, a statute must be drawn with such care and precision that it can be neither ignorantly nor intentionally misunderstood. Perhaps this is a goal quite unattainable, but our aim should be to reduce to a minimum the opportunities of the lawyer, who, driven by the special innterests of his client, endeavors to have the courts so construe a law as to furtehr those interests.

With so many difficulties before him and so inadequate an equipment to contend with them, the legislator makes many blunders. The responsibility for these blunders the courts unhesitatingly place upon the lawmaker. In the Moffitt case, 35. Cal., Dec., 379, the California court says, "For their ignorance they, and not the courts are responsible, and for their omissions they, and not the courts, must find a remedy."

Criticism like the above forced the legislature to take some steps to protect itself and to preserve its dignity. It is almost a truism that in every carelessly drafted statute there lurks an unnecessary and expensive lawsuit. The legislatures of many states, including our own, have made numerous more or less adequate provisions for assistance to lawmakers in their work. It should not be necessary to advance argument in support of the position taken by publicists

* The italics are the writer's.

and lawmakers that such assistance is necessary. The committee of the American Bar Association above referred to offered the following resolution which was adopted:

"Resolved, that, in the opinion of the Association, official legislative drafting and reference service, when properly organized and directed, forms an efficient agency tending to prevent the accumulation of unconstitutional, obscure and otherwise defective statutes, and to secure the utmost brevity and simplicity consistent with accuracy in the language of statutes, and we hereby recommend the establishment and general support of such service at Washington and in those states not now having such service."

That the presence of lawyers of commanding ability does not necessarily insure technical accuracy in legislative bills is the unanimous opinion of the Committee on the Library of the United States Senate. Senator Root, chairman of this committee, offered a report upon a bill providing for the creation of a legislative reference bureau and for the establishment of a drafting service for Congress, recommending that the bill be passed, in which the following appears:

"There is a general agreement that there are serious defects prevailing in our legislation, both in Congress and in our State legislatures. These defects arise in part from the fact that the many provisions are drafted as matters of first impression. Words are used which seem to the draftsman adapted to accomplish his purpose, but when these words are considered in connection with all the existing laws of which they are made to form a part they may have an entirely different effect from that which was intended, and when they are considered with reference to all the existing decisions of the courts by which they may be construed they are often found to be utterly futile or to produce quite unexpected results.

"The effect of continually thrusting provisions into the body of a law without considering carefully what is already there is to make a jumble of statutes which creates uncertainty, breeds litigation, and makes the law ineffective. Another difficulty arises from the fact that the drafting of statutes demands exceptional capacity for clear and definite statement, and many very strong and useful legislators have not that capacity. This subject has now been before Congress a number of years. Many bills have been introduced in the Senate and the House. The House committee had very full hearings several years ago and the Senate Committee on the Library has had the benefit of those hearings. The committee transmits herewith as part of this report a printed copy of the hearings taken before it upon which it has based its conclusions."

This committee heard the testimony of experts and of former ambassador James Bryce, all of whom pointed out the grave necessity for such assistance to senators and representatives. The committee unanimously recommended the passage of the bill. In the House, the sentiment of the committee in charge of a similar bill was also unanimous in favor of its passage. Speaker Clark, minority leader Mann, and other eminent men of all parties urged the need of such service in some form.

More than half of the states in the Union now have legislative reference bureaus, and many of these have made generous provision for drafting service, as referred to by the Committee of the American Bar Association. The state of New York, for example, employs eight lawyers, and twelve clerks and assistants whose duty it is to assist the lawmakers at Albany in the technical work of preparing legislative bills. Wisconsin employs three expert draftsmen, with clerks and assistants, some of whom are on duty two months before the legislature convenes. The legislature appropriates $9000.00 for the support of this service in Wisconsin. Indiana maintains a reference and drafting bureau for the maintenance of which an appropriation of $13,500.00 is made. Many other states assist legislators in the preparation of bills, among these may be mentioned Massachusetts, Connecticut, Illinois, Pennsylvania, Nebraska, California, Michigan, Ohio, Texas, Vermont, and South Dakota.

In 1907, as has already been said, the legislature of North Dakota passed a law creating the State Library Commission, which has now become one of the very important educational agencies in the state. Among the duties of the commission was that of employing a legislative librarian whose duty, under the law as amended in 1909, is to gather, classify, and condense information on every possible subject that may come up for consideration before the legislature. It is also provided in the amendment that the legislative librarian shall assist members of the legislature in the preparation of bills.

In order to lay this matter as clearly as possible before the readers of the Quarterly Journal it becomes necessary to explain in some detail the actual work done in the legislative reference bureau in assisting members in the preparation of bills. This work was done for the first time during the session of 1909. The legislative librarian soon found that with the demand for reference material on subjects before the legislature there arose, likewise, a demand for assistance in the drafting of bills. This assistance was given as frequently as the limited time and experience of the librarian permitted.

In the session of 1911 the librarian found the demand for drafting as well as for the purely reference work almost doubled. In that session it appeared that the full time of the librarian and an assistant was required in order to meet reasonably the demand for this service. During the session of 1913 the demand for this work was greater than it ever had been before. Not only did individual members call upon the legislative librarian and his assistant to draft bills for them, but committees and sub-committees asked them to prepare amendments and, in some cases, entire bills. During this session about one-sixth of the bills introduced were either partly or wholly drafted in the legislative department.

For this work the legislature has made no special appropriation, but the service is maintained out of the comparatively small appropriation made for the general work of the Library Commission. In 1909 a bill passed providing for a legislative drafting bureau, but this was vetoed by the governor for the reason, among others, that there was no room in the Capitol for such a department. Again, in 1913, attempt was made to create such a bureau. The bill passed the Senate, but in the rush at the end of the session was lost in the House. From the experience of North Dakota as well as that of other states it seems clear that more adequate provision must be made for this service before very long. The demand has already outrun the means at the command of the commission to meet it.

Experience in this state and elsewhere has shown that the reference work and the drafting service should not be separated. The demand for the one naturally gives rise to a demand for the other. This conclusion is in harmony with the findings on this question by the committee of the American Bar Association referred to above. No experienced draftsman will propose a bill of any importance without consulting the experience of other states and countries in dealing with the case before him. For this purpose the specialized reference library is the only available source of information.

It is also clear that the legislative reference bureau should not be maintained in connection with the state Law Library. The two have entirely different and distinct functions to perform. This conclusion is also in harmony with that of the committee mentioned in the preceding paragraph.

In providing reference and drafting service for the state legislature the cardinal principle is that it be free from political influence of every kind. Nothing could be more overwhelmingly disastrous to the usefulness of this service than its subordination to the selfish ends of politicians. To serve all on equal terms, regardless of faction

or of party, is alike its purpose and its justification. To be permanently useful it must command the confidence of every member, but let it be suspected that partisanship has laid a profane hand upon this bureau and confidence would take wings and the value of the service disappear. It has been the good fortune of the department as heretofore and now constituted to be free from every imputation of partisan control and there is reason to believe that in the future it will enjoy the like immunity.

Some Rules for Draftsmen

In this article it is impossible to offer anything more than an outline of the principles that should govern in the preparation of a legislative bill. It is, however, deemed proper to call attention to a few of these in the hope that so doing may be of service to a reader who directly or indirectly may become responsible for the technical correctness of a statute.

1. As a first principle the draftsman must clearly understand the conditions he desires to correct and he should have a thoroly clear conception of the remedy he proposes: in other words, he must have thought the subject thru until he has thoroly mastered it in all its details.

2. The state constitution prohibits the legislature from enacting laws upon certain subjects and provides how laws upon other subjects shall be made: that is to say, the state constitution, in contrast with the federal constitution, which is a delegation of power is a limitation upon the power of the legislature to pass laws. With these limitations the lawmaker must be familiar. He should, therefore, before he begins the preparation of his bill, examine the constitution and ascertain if it expressly or impliedly prohibits the legislature from passing a law upon the particular subject he has in mind, or, in case the subject matter is not prohibited, if the method contemplated by him is constitutional.

3. Having satisfied himself that the constitution does not prohibit legislation upon the subject or in the manner he has in mind, the lawmaker should examine the existing statutes to find out to what extent, if any, it is dealt with in them. If a statute is found dealing with this subject he should introduce his bill as an amendment to the most closely related existing law. One reason for the alarming expansion of our codes is the fact that an unnecessarily large number of statutes are passed as independent enactments instead of being inserted by way of amendments to existing laws.

Constitutional Requirements as to Form of Bills

The constitution requires that bills be in certain form and that all laws should be made by bills duly passed. The formal parts of a legislative bill in North Dakota are as follows:

Senate Bill No. 1

Introduced by Mr. Jones

A bill for an act to create a Legislative Drafting Bureau.

Be it enacted by the Legislative Assembly of the State of North Dakota.

Section 1. (Here follows the body of the bill.)

The provision in the constitution which requires that all laws shall be introduced in the form of a bill seems to preclude law-making by resolution. This matter is worthy of consideration for the reason that attempt is frequently made to appropriate money from the treasury by the somewhat easy expedient of a resolution. That this cannot be constitutionally accomplished, is scarcely to be doubted. Sections 58, 59, 79, and 180 throw some light on this point, and the Supreme Court of Colorado appears to have decided against this method of appropriating money.[1]

Constitutional Requirements as to Subject Matter

The constitution provides that no bill shall contain more than one subject and that this subject must be exprest in the title. It is frequently a question of some difficulty to decide when the subject matter of a bill is multifarious. The Minnesota court has, on this point, exprest itself as follows: "To constitute duplicity of subject an act must embrace two or more discordant and dissimilar subjects that by no fair intendment can be considered as having any legitimate connection with or relation to each other."[2]

It is to be borne in mind that while the subject must be singular the *provisions* in the act to accomplish the object thereof may be multifarious.

The constitutional requirement that the subject must be exprest in the title is satisfied when the title is as broad as the scope of the bill. If the title be narrower than the subject matter of the bill, so much of the act, if it be separable from the remainder, as is not exprest in the title is void.

While the constitution requires that the subject matter shall be exprest in the title of the bill, it is not necessary that the title shall

1. Henderson v. Collier, 30 Pac. 40. See also: State v. Rogers, 10 Nev. 250.
2. Johnson v. Harrison, 47 Minn. 574.

be a table of contents. It is sufficient if the subject matter is clearly expressed, but it is not necessary to give the details by means of which the purpose of the bill is to be accomplished. To encumber the title with details, as our lawmakers frequently do, is both confusing and wasteful. In a decision of a California case the court says, "I see nothing in the Constitution which requires that the title shall disclose the purpose and scope of the act. It is enough if it intelligently refers the latter to the subject to which the act applies or which is affected by it."[3] Decisions in other California cases touch the same point.[4]

When a bill is intended to amend an existing statute, the constitutional requirement as to title is satisfied by giving the section number in the title, but it is the better practise to state also to what subject matter the section relates.

Uniform Operation

The constitution requires that general laws must have a uniform operation. This provision is satisfied when the bill or law has the same operation in all parts of the state under the same circumstances and conditions.[5]

In passing, attention should be called to the constitutional requirement that no special or local law shall be passed except in cases specifically enumerated in sections 69 and 70 of the Constitution. This prohibition cannot be evaded by the device of making the form of the bill general when in point of fact it is local and special in its nature. An instance is recalled when such an evasion was attempted. During the session of 1913 a member of the legislature desired the passage of a law affecting a certain office in his own county, but did not want it to affect the same offices in the other counties of the state. He, therefore, provided that the law should apply only to counties organized before a certain time, and, inasmuch as the county he represented was the only county organized before this date, his purpose would be accomplished. That such a law, had it passed, would have been unconstitutional there is little question, at least such manifest attempts at local and special legislation in the guise of a general law have been, by the courts of other states, uniformly held unconstitutional.

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5. Hellman v. Schmitters, 114 Cal. 148.
6. San Francisco v. Keenan, 99 Cal. 614, 622
   People v. Superior Court, 100 Cal. 105.
   People v. Linda, 128 Cal. 477.
4. Groesch v. State, 42 Ind. 547.
   Plummer v. Burnham, 8 N. D. 161, 84 N. W. 690

Present Tense

Every law, theoretically, speaks in the present. It is always operative, therefore the proper tense is the present. Confusion and sometimes absurdity result when the draftsman attempts to use the future tense.

"Shall" and "May"

Few words are more frequently misused in legislative bills and statutes than "shall" and "may." Because of careless use of these words the courts have been forced, at times, to construe the former as directory and the latter as mandatory, contrary to their natural meaning. If the lawmaker desires to command something to be done or not to be done, "shall" should be employed. If, on the contrary, he desires to make the performance or non-performance of an act discretionary with the person affected, he should use the word "may." Such expressions of frequent occurence in statutes as "it shall be lawful," or "it shall be unlawful," are improper and result in confusion. Words clearly indicating discretion or prohibition should be used.

Punctuation Marks

The draftsman should bear in mind that punctuation marks are not parts of the statute, but that altho this is the general rule laid down by the courts, yet, punctuation marks may be considered in aid of construction as a last resort in cases of ambiguity.

Legislative Procedure

Much has been said about the inefficiency, of the superabundant lawmaking of the average state legislature in America. It is said that the procedure is antiquated and unsuited to the amount and kind of business to be done. In support of this criticism much apparently convincing proof can be adduced. It is not the purpose, as has been intimated, to disprove any of these charges or to defend the state legislature against possible criticism. It may be pointed out, however, that the evidence offered, frequently accepted as conclusive, to prove the inefficiency of the average state legislature in this country, is obtainable in almost equal abundance against the legislature of North Dakota. Attention will now be called to some of the proofs that are usually offered in support of the charge of inefficiency.

It is said that Americans have a mania for lawmaking. Every petty grievance evokes a desire in the bosom of some solon to prohibit or regulate it by law. During the years 1909, 1911, and 1913

there were introduced in our state legislatures 43,772, 46,411, and 55,873 legislative bills, respectively. Probably about one-third, or 50,000,of these bills passed and became laws. In Congress the total number of bills and resolutions introduced increased from 20,893 in the fifty-sixth to 44,363 in the sixty-first Congress. The total number of public acts passed by the fifty-sixth Congress was 443 while the sixty-first passed 594 public acts. For the private acts and resolutions passed by the same Congresses the figures are 1505 and 288, respectively.

These figures seem to suggest an alarming situation, so alarming indeed that men have said that the wisest act any legislature could do would be to repeal all laws and adjourn, sine die. That this proposal will commend itself to the sober judgment of our lawmakers is not to be expected, but that it reflects a view, in extreme form, widely entertained cannot be doubted. It is clear, however, that the conditions of affairs is not so serious as the above figures, on their face, might lead us to believe. A very large proportion—how large we cannot tell, as we have not had time to make the necessary investigation for the entire country—of the laws passed are amendments to existing laws which, in many instances, effect only slight and unimportant changes in, or are merely corrections or repeals of, statutes formerly adopted. In North Dakota, during the session of 1913, 165 out of a total of 319, or 51 per cent, were repeals of existing statutes or amendments to them. Of course, that these changes and corrections should be necessary may be accepted as evidence of a lack of legislative wisdom and efficiency, but a proper interpretation of these figures requires that we consider the situation in all its bearings.

During the last three sessions of our legislature the number of bills introduced was as follows:

	Total Number of Bills	Number of Bills per Member	Total Number of Members
1909	734	5.2	142
1911	821	5.4	152
1913	892	5.5	162

From this table it appears that while the total number of bills introduced at each session has increased by 158 since 1909, the number per member has increased only three tenths of a bill.

With respect to the average number of bills introduced per member in North Dakota in 1913, we have to conclude—whether it be a compliment or a reflection, need not now be decided—that

our state is comparatively sane and conservative. Only three states of the Union show a smaller number, namely, Montana, Rhode Island, and Wyoming with 5.2, 5.1, and 4.6 bills per member in the order named, and a total number of 610, 711, and 392, bills respectively. Texas, with 164 members as compared with our 161, shows a total of 1,397 bills or 8 per member.

State	No. of Members	No. of Bills	Bills per Member
North Dakota	161	889	5.5
California	120	3,922	32
Delaware	52	625	11
Nevada	74	480	6
Iowa	158	1,264	8
Montana	116	610	5.2
Minnesota	181	2,226	12.3
Maine[6]	182	1,396	7.6
Arkansas	135	743	5.5
New York	195	4,081	20.9
North Carolina	170	4,308	25
Idaho	85	635	7.4
Oregon	90	971	10.7
Washington	183	1,200	8.9
Wisconsin	133	1,759	13.2

Why is there such a wide difference, not only in the tital number of bills introduced in the several states, but in the average per member? Is it because of the complexity of industry or the diversity of interests, or the habits of thought of the people, or is it determined solely by the logic of chance?

Passing now to the question of consideration of bills by the legislature, we find a situation that is somewhat startling on its face. In 1909, 249 bills passed, or 33.9% of the total number of bills introduced; in 1911, 330 bills passed, or 40.2% of the total number introduced; and in 1913, 318 bills passed, or 35.6% of the total number introduced during the session. That there is some misdirected energy and wasted effort here, there seems no question. Evidently much of the time of the legislator is taken up with the consideration of bills that never become laws.

But not only is there a waste of energy and valuable time, but a large sum of money is expended for the printing of the bills that are lost. The cost of printing legislative bills, exclusive of the cost

6. Printed bills only.

of printing references to them in the journals of the two houses, was, during the session of 1914, $14,850.83. The average cost per bill was, therefore, a little over $16.00. The total cost of the legislative session was $111,039.94. This amount, apportioned on the basis of the number of bills introduced, gives an actual cost of each legislative bill introduced of $124.48, and the cost of each bill passed, on the same basis, was $349.18. To save the cost of printing bills not likely to pass both houses successfully, the state of Indiana does not print bills until they have been favorably reported out of the committee to which they were referred. In Minnesota, a similar rule was at one time in force. While the practise saves some money, the plan is open to the criticism that meritorious mesures do not receive the publicity the printing of bills gives them. In Indiana, according to the opinions of men who have had experience in the legislature, bills are not sufficiently considered in committee because printed copies are not available. On the whole, it is probable that the expense of printing the uselss with the meritorious bills is outweighed by the advantages from the publicity received and the resulting opportunity that the public and interested parties have of offering helpful suggestions.

Much money is wasted in printing and time is consumed in considering duplicate bills. For the practise of duplication there is ordinarily no justification possible. During the last session five "blue sky" bills were introduced. These bills all covered the subject in very much the same manner and all were copied from the statute books of some state. It cost the state about $140.00 to print these, four-fifths of which expense should have been avaided. This is only one of many instances that could be cited where much waste of time and money results from introducing many bills on the same subject. Open to the same criticism is the practise of introducing the same bill in both houses.

It is said, and with much reason, that one member cannot possibly know whether or not some one of the remaining 160 has introduced a bill on the same subject or amending the same section in the code. This is true under the present system . But a single clerk, at a cost to the state of $250.00 for the session, could by a simple card and filing system, in co-operation with the drafting bureau, at a moment's notice inform any person interested just what bills on any given subject had already been introduced. A joint rule should then require him to offer his suggestions to the committee in charge of the bill, already in its hands, covering the same subject or section in the code, or to the original framer of the bill. If the suggestion is meri-

torious and is adopted by the committee, the bill may bear the names of both men, or it may be made a committee bill, to avoid the small jealousies to which even lawmakers are sometimes prey. The writer has seen such a system in operation in another state and it worked smoothly and effectively.

It is the experience of the men who have drafted some of the bills in the legislative reference department, at Bismarck, that most members are glad to be informed of facts that enable them to avoid the wastes of duplication. In fact, numerous cases are recalled where members, upon learning that a bill covering the subject was already in, did not insist that the draftsman prepare another bill, but took their suggestions before the committee, if the bill in its hands did not embody all their ideas.

Our legislative session is limited in length by the constitution to sixty days. It therefore becomes necessary for the lawmakers to consider all these bills and to dispose of them individually by some appropriate legislative action. The normal legislative day is from 10:00 o'clock in the morning to 12:00 o'clock at noon, and from 2:00 o'clock until 5:00 in the afternoon Indeed, during the early part of the session neither house convenes in the forenoon. Of course, when the legislature is not sitting, its committees are at work on the bills that have been referred to them. The vast majority of the bills that become laws are passed by both houses without any discussion except in committees, or in the committee of the whole, and the majority are probably passed without any discussion in the committee of the whole house, all the consideration of the bill being given it in the standing committee.

Perhaps in no better way can some idea of the congestion of work be conveyed to the readers of the Quarterly Journal than by examining the space in the journals of the two houses devoted to the proceedinngs of the last few days of the session. The following tables prepared by one of my students[7] in Practical Legislation exhibits in graphic and concrete form the congestion that attends upon the last days of each session:

Table I
SENATE JOURNAL

Weeks	Dates								Pages	No.	No. last week
1	Tuesday,	Jan.	7,	to	Tuesday,	Jan.	14		1-37	36	672
2	"	"	14	"	"	"	21		37-125	88	
3	"	"	21	"	"	"	28		125-202	77	
4	"	"	28	"	"	Feb.	4		202-253	51	
5	"	Feb.	4	"	"	"	11		253-357	104	
6	"	"	11	"	"	"	18		357-525	168	
7	"	"	18	"	"	"	25		525-740	215	
8	"	"	25	"	"	Mar.	4		740-1100	360	
9	"	Mar.	4	"	"	"	7		1100-1632	532	

7. Mr. Jacob A. Hofto.

Table II
HOUSE JOURNAL

Weeks	Dates								Pages	No.	No. last week
1	Tuesday,	Jan.	7,	to	Tuesday,	Jan.	14		1-215	214	680
2	"	"	14	"	"	"	21		215-290	75	
3	"	"	21	"	"	"	28		290-407	117	
4	"	"	28	"	"	Feb.	4		407-473	66	
5	"	Feb.	4	"	"	"	11		473-629	156	
6	"	"	11	"	"	"	18		629-860	231	
7	"	"	18	"	"	"	25		860-1124	264	
8	"	"	25	"	"	Mar.	4		1124-1539	415	
9	"	Mar.	4	"	"	"	7		1539-2084	545	

N. B.—The ninth week consists of but four days.

It will be noticed that during the 9th week, which consists of only four days, 532 pages of the Senate Journal and 545 pages of the House Journal were devoted to the proceedings of the two houses respectively. A still more startling condition is disclosed by an examination of the proceedings of the last day. It appears that 210 pages of the Senate Journal are devoted to the proceedings of the last day, or about 13% of the entire space in the Journal. In the House the proceedings of the last day fill 260 pages of the Journal of that body, which equals approximately 12% of the Journal of the House for the entire session. In other words, the proceedings of the last day of the Senate occupy more space in the Journal than the proceedings during the first three weeks of the session. In the House the proceedings of the last day occupy more space than those of the second, third and fourth weeks of the session.

The same situation may be presented in another way. Of the total number of House bills passed by the Senate, 79% were passed during the last six days, and of the total number of Senate bills passed by the House, 75% were passed during the last six days. On the last day the House entertained 195 motions, or 16% of the entire number of motions entertained during the session. On the last day the legislature considered 14% of the total number of motions entertained during the session. Both houses listened to eighty-eight committee reports during the last day, or 7½% of the entire number of committee reports of both branches. The House passed four House bills and 57 Senate bills during the 60th day, or 3% of all bills passed for the House, and 32.5% of all Senate bills passed. The Senate passed 50 House bills on the last day, or 32.9% of all House bills passed during the session. In other words, 33.7½ of all bills passed were passed thru the second chamber on the last day.[8]

By statistics like these the critics of our state legislatures support their contention that the legislature is inefficient, and that law-making is hasty and ill-considered. That there is much merit in this

8 These figures were compiled by Mr. Jacob A. Hofto from the Journals as a part of his work for the Master's degree at the University of North Dakota in 1914.

criticism no one will deny, but that the significance of these facts is frequently exaggerated is equally indisputable.

As was pointed out in a preceding paragraph, all the bills passed upon by the House have been discust in committee. In practise, the lawmaking body usually discusses the reports of the committees, but during the last day of the session the report almost always received favorable consideration by the House without debate, the pressure of time and the amount of work undone having, by common consent, forced the members to abandon all debate.

The Divided Session

It is not to be denied that this congestion toward the end of the session is a very grave evil for which some remedy ought to be discovered. While critics have found it easy to point out the evil, they have failed utterly to suggest any practical mesure of relief. The legislature of California is experimenting with a device which its friends hope will partly solve the problem of obtaining adequate consideration for legislative bills. The system, briefly, is as follows: the legislature meets and sist for thirty days, during which time bills are introduced. Then a recess for thirty days is taken during which time committees are expected to be at work upon the bills referred to them. After the expiration of the recess, the legislature convenes again and the committees report the result of their deliberations. During the second period of the session bills may not be introduced except by consent of three-fourths of the members of each house. This constitutional provision was adopted in California in October, 1911, and has been in operation since that time. In the Senate 1717 bills were introduced during the first session and 60 in the second. In the House 2021 bills were introduced at the first session and 105 at the second session.

How this plan worked in California it is difficult to say. Members of the legislature are very much divided in their opinions. It seems doubtful if such an expedient can accomplish its intended purpose unless some assurance be had that the committees during the recess actually work upon the bills referred to them. In the absence of some such provision or guaranty it is not improbable, if we may judge the lawmaker of the future by the known habits of the legislators of the past and present, that members would retire to their homes and return at the end of the recess without having actively considered the bills referred to their committees. The plan, however, is worthy of serious consideration, and its working in California will be watched with much interest.

No less difficult of solution is the problem of reducing or limiting the number of bills introduced at each session. The adoption of House or Senate rules fixing a date after which no new bills may be introduced, has by actual and repeated experience, in many states, proved entirely futile. The mutual obligation of legislative curtesy acknowledged among lawmakers constitute a barrier in the way of enforcing such rules. Again, to limit the number by a constitutional amendment would merely add another prohibition to an instrument already full of checks, the wisdom of some of which we may well question in view of the fact that several amendments to it are adopted by the people at every general election. True, it is rather startling to reflect that about 100,000 legislative bills should be introduced in this country every other year, including Congress, which costs the taxpayers over $1,600,000 for printing alone, but it may be replied, it is merely another illustration of the fact that liberty is a costly thing. It is not far from an axiom that the more popular the government, the more direct the participation of the common citizen in public affairs, the greater will the cost of such government be. Doubtless we could get along well enough were only half this number of bills introduced each legislative year and avoid expense as well, but immunity from this expense could be purchased only at the price of a privilege we have grown accustomed to believe belongs to a lawmaker in a free country. It is a question of relative values after all. Now every citizen feels free to call upon his representative to introduce any mesure in which he is interested and his representative is equally at liberty to introduce the bill and usually does it. If it costs money to print these bills and if much valuable time is consumed in their consideration the citizen should remember that this expense is the price of a privilege he has seen fit to retain.

It is probable that no single device will completely and permanently remove the evil of congestion and of multiplicity of legislative bills which seem to be universally characteristic of state legislators. For congestion of work relief must be sought in a more efficient organization of the legislature, and, probably, thru a reduction of its membership,, now so large as to make that body cumbrous and unwieldy. It seems, however, that many minor changes could be made in the organization of the legislature and in its rules of procedure that would facilitate action and result in a better consideration of legislative bills. A system of joint committees, common in some New England states, might be efficacious if members earnestly desired to expedite business.

A simple device which could save much time both of the committees and of the houses in our state legislature has been attempted in many states such as New York and Wisconsin as well as by the national Congress at the present time. When a bill is introduced amending an existing law by adding to it or striking from it certain provisions it is impossible for the member to know what is new matter and what matter is dropt out, without a careful reading of the whole section to be amended. If the section is long it is frequently impossible for him to determine without much study and comparative reading, which requires the assistance of another person, the effect of the proposed amendments. The writer has seen much time lost in the House when members have risen to inquire what the effect of proposed amendments was, saying that they had no means of telling without careful study of the bill. This difficulty could be entirely removed, certainly reduced to a minimum, by the simple expedient of printing new matter in italics and enclosing matter to be dropt out in brackets. If this should be done, and it can be done at practically no increased expense to the state, every member could tell at a glance the precise effect of every amendment proposed to the Compiled Laws.

The great defect of the American state legislature is the total lack of centralized, definite responsibility. All bills, whether good, bad or indifferent, are on the same basis. If some system could be devised whereby the important bills, the administrative mesures, should have precedence, much of the evil complained of would disappear. If, instead of, or supplementary to, the executive message, the governor submitted his recommendations in the forms of bills, which under the constitution, would be entitled to precedence over all other mesures proposed, and if he should have the right to appoint spokesmen for him in both houses, whose duty it would be to pilot his bills and defend and explain them, we would have not only definite responsibility, but a systematic consideration of bills in the order of their importance.

Recently suggestions have quite frequently been made by men of prominence that the state legislature should be abolished and that a small body or commission of experts be substituted. All these proposals, it seems, contemplate that this small body of men, experts as they are called, be elected by the people for a long term, and that they be in session continually. In this way it is hoped that the errors which present legislators fall into and the ludicrous mistakes that careless or ignorant lawmakers now make will be entirely removed, and that our statutory law will be drafted carefully and that our

statutes thenceforth will be symmetrical, clear, concise, and free from ambiguity of every sort. That this is a consummation devoutly to be hoped for all will agree, but that the means suggested are the most appropriate to accomplish this end is not so certain. It is doubtful if the advocates of this small legislative body fully realize that the people do not elect experts. They do not elect men because they are wise or well equipped. They elect them because they like them, and they like them, not necessarily because of their talent or their abilities, but for many reasons entirely unconnected with their qualifications. It is the sorrow of patriots and the lament of statesmen and of students of government that the voter is not always discriminating in his choice of the man who administers the government.

The legislature makes many mistakes, it commits many blunders, but maybe most of these are merely the penalties that a people must pay for being free. Perhaps they are the costs of democracy, costs which should be reduced as much as wisdom can sanction and experience suggest, but which, perhaps, can never be wholly removed without endangering the very freedom which our institutions were intended to preserve.

It was the desire of the fathers as it has been the prayer of the friends and lovers of the republic that its institutions be forever instinct with the spirit of democracy. Whatever we may think, whatever we may say in contempt and scorn of the ordinary, very ordinary, man who helps to make our laws, he at least comes directly from the masses of the people for the protection of whose rights of life, liberty, and property we proudly assert governments are instituted among men. He lives and has lived among them; he knows their needs, their hopes, their fears, and their suspicions; unchanged by the fawning arts of the professional politician, untouched by the sinister appeal of the privilege hunter, he comes to his work, unlearned, perhaps, unlettered, it may be, but fresh from the people, impelled by the same impulses of hope, restrained by the same sentiments of fear that stir the bosoms of the thousands for whom he has been appointed to make the law. It seems the greater wisdom, it seems more in keeping with the spirit of our government that we should strive to improve rather than destroy or fundamentally modify our legislative system; that we provide lawmakers with adequate assistance, rather than substitute so called experts for them; that we give them what we have denied them, equal opportunity to be efficient with the other branches of the government.

Some Prison Problems in North Dakota

George R. Davies,

Assistant Professor of Sociology, University of North Dakota

There are many phases of the problem of handling the convict in North Dakota that might be discust. The intention is, however, to limit the subject to the problems arising in connection with the handling of felons; that is, to the work of the State Penitentiary. This paper is based in large part on a visit of a few days to that institution, during which the management kindly allowed the writer every opportunity to come into contact with the men and to see the work from every side. Of course such a study necessarily was superficial; a real acquaintance with a prison could not be gained in so short a time. But the kind assistance given by officers and men, from the Warden and a member of the Board of Control down to the inmates of "solitary," supplemented the writer's necessarily limited observations, and so it is hoped that the following informal descriptions may show something of the problems that the state is trying to solve thru the agency of the penitentiary.

The penitentiary is located a couple of miles outside the city of Bismarck. Approaching it from the city one sees its best side, as the buildings screen the forbidding prison walls and towers that overlook the yard in the rear. To the left of the clustered buildings are one or two residences, well-kept barns, gardens, and yards; while fields, in part tilled by convicts, fill the background. Passing thru the buildings for the first time, the visitor meets a variedly interesting scene. He passes outer offices, is admitted thru heavy, barred doors, looks hastily thru shops, living quarters, and kitchen, and inspects curiously the cell house with its long tiers of tiny brick-walled rooms that somehow suggest menagerie cages. Then a solid iron back-door swings open, but not to the free outdoors. Here is the prison yard with its clustered shops, warehouses, and factory, exhibiting thruout a scene of busy industry. From within, the great brick walls enclosing the area look as formidable as a medieval castle. In the immediate foreground is a beautiful flower garden, the pride of an old convict. In the farther corner, in an angle in the wall, is crowded a baseball diamond.

It is not, however, the architectural or industrial side of the penitentiary that the visitor finds himself interested in, but the human

side. One feels vaguely in the background the tragedies of wasted careers, of broken homes, of grieving relatives; yes, and of the law's crude mishandling of human nature. It will perhaps be best, however, before taking up individual cases to describe the daily routine to which the inmates are subjected.

When a convict is brought to the penitentiary, after certain formalities are concluded, he is taken to a room in the hospital building where he is photographed and mesured for future identification. Next he goes to the shower bath. Here after a thoro cleaning and an examination for scars and tattoos that may be used as indentification marks, he is provided with prison clothes. The clothes are of grey wool or kahki, according to the season. The outfit furnished is well adapted to the needs of the men and is not designed to humiliate as was the case with the stripes formerly in use. At a barber shop maintained by the convicts the new man has his hair neatly trimmed,—not cropped as was formerly the prison style. He now is sent to his cell to await the assignment of some task. The first task will probably be the shoveling of coal, but after a day or two at this work the man will be shifted, and eventually will be given the work best adapted to his ability and former experience, as far as the possibilities of the prison permit.

From what has been said about the clothes of the men it will be seen that some of the distinctive features of old-time prison life have been outgrown. This fact is still more emphatically brought home to the visitor when he observes the conduct of the inmates. The lock step and the rule of silence have gone the way of the stripes and the cropping of the hair. To see the men pass in from the shops to the mess house at the closing signal one could hardly tell them from a group of workmen outside. They walk in irregular groups talking naturally with one another. The same liberty of speech is carried into the dining hall and the shops. It is undoubtedly the case that such liberty makes for good order in the prison and for improvement in the sanity and morals of the men. The unnatural repression of too strict a system results in outbreaks in which a man will rebel, in almost a fit of desperation, very much like a child in a tantrum. More than one of the convicts who have been in the institution for a long time commented on the wholesome effect of a regime of reasonable liberties, as contrasted with the older systems of silence and military precision. One in particular recalled the vivid memory of a night he had spent in his cell years ago, when a prisoner close to him wildly cursed and tore at the bars, while another, in as great abandon shouted prayers

to Heaven for mercy. He said that it was with great difficulty that he restrained himself from a like hysteria.

At the meals, as has just been said, the men are allowed liberty to converse, and the behavior here as elsewhere in the prison is much like that among workmen in general. No armed guards are present, but order is maintained by two or three of the officers who move about from table to table. I ate several meals with the men, and did not observe any abuses of the liberties accorded, except in one instance when two men engaged in a dispute that might have led to blows but for the watchful officers. As this incident indicates, repression is sometimes necessary. To facilitate discipline the management is planning to adopt a somewhat more systematic order of passing to and from the dining room and shops. But in general the conduct of the men is entirely satisfactory, and the system of natural liberties within the limits of the prison routine will be continued. As to the food served, it is good in quality, of considerable variety, and is well cooked. With only one or two exceptions the men exprest themselves as well satisfied with their rations. The quality of the food is maintained by an excellent system of purchasing and inspection in which the state pure food department cooperates. The kitchens, recently remodeled and fully equipped, give every facility for the proper cooking of the food. The following bill of fare was served on one of the days of my visit, and is typical:

Breakfast: Cornmeal mush, milk, boiled eggs, fried potatoes, bread, syrup, coffee.

Dinner: Pea soup, salmon, boiled potatoes, gravy, creamed onions, bread, cottage pudding with lemon sauce, coffee, milk.

Supper: Fried liver, gravy, fried potatoes, bread, corn bread, fruit, syrup, tea, milk.

The men work ten hours a day, from seven in the morning to six in the evening, with an hour for dinner. As partial compensation, the State allows them fifteen cents a day, and a fair wage for over-time. They spend the evenings in the cell house with some freedom of visiting back and forth. One or two evenings in the week they are given the freedom of the prison yard, where they play ball or engage in other pastimes. Those who play in the prison band or orchestra often spend the evening in practise. At nine o'clock all are locked in the cells for the night.

Perhaps I can best give a description of the cells by recounting my experience in one of them. One evening during my visit the Warden at my request had a cell assigned me. I asked for

this experience with the idea that perhaps it would enable me to see prison life from the prisoner's standpoint a little more easily. There were in the background of my mind various descriptions I had read of the feeling of desperation and resistance that comes over a man as the steel door clangs upon him, and he finds himself immured in the stone walls. This, I had read, was the experience of those who came as I did as well as of those who actually were prisoners. I must say that my experience from this standpoint was entirely disappointing; in fact, it was prosaic in the extreme.

I had been spending the evening with the Warden listening to the personal interviews he was holding with the men, and it was after lock-up time when the keeper guided me down the half-lighted corridor past the now darkened cells. I was conducted to one of the cells on the lower of the four tiers, and found myself in a tiny room about ten feet long, eight feet wide, and seven feet high. On one side was a cot suspended from brackets, so that during the day time it could be folded up against the wall. On the other side was a small table and chair. In the end of the cell were toilet facilities—lavatory and closet—with running water. I found later that the section of cells first built, known as the old cell house—tho it is a part of the same structure and continuous with the newer part,—does not have these facilities, but is equipped with the iron slop-bucket and wash basin familiar to most prisons. There was an electric bulb close to the ceiling, but this could not be used now that the lights had been turned off for the night, so I was obliged to undress by the faint light reflected from the corridor. I lay down on the narrow straw mattress, placed my head on a high and rather solid straw pillow, and drew over me the clean and ample covers. As to the pillow, a neighbor in a nearby cell told me the next day that I should have stamped it down on the floor and doubled it over until it was reduced to the right dimensions and softness. But I was comfortable, and lay for a time gazing thru the locked iron grating that served as a door, to the big prison windows across the corridor from which a refreshing breeze was blowing. Outside a storm was raging. Within the building the silence was but slightly broken by occasional sounds that came muffled thru the brick walls or reflected down the corridor: the snoring of sound sleepers, the muttering of a man talking in his sleep, a curse from a neighboring sleepless inmate, or the slippered tread of the guard as he made his hourly rounds. I lay awake for some time trying to conjure myself into

a suitable appreciation of the horrors of being locked behind steel bars, but it was useless; I could experience nothing but a commonplace drowsiness.

I think I had not slept many minutes before I awakened with a feeling of discomfort. Moving my arm at random across the pillow, I noticed that a dark stain developed; I had crushed one of numerous bedfellows for whom bars were no obstacle. To relate briefly what was to me a very long story, I found that what I had hoped would be an illuminating experience of prison life had degenerated into an exceedingly sordid tussle. But at last the morning dawned, the waking gong rang,—tho it was not necessary in my case,—the keeper unlocked the cells, and we filed out to breakfast.

I learned on talking with the men that the problem of vermin is not so serious as I had taken it to be. Many inmates had had the same experience as I the first night in prison. But a man who gives a little attention to the matter finds no trouble in keeping his cell clean. On request the convict attendant who looks after the cells will "burn out" the cell; that is, use the flame of a small gasoline torch in all the chinks of the brick wall. If all the men were anxious to keep the vermin down, the problem could be readily solved; but some are indifferent and allow the pests to breed. Perhaps their feelings are illustrated by the attitude of the attendant just mentioned. He seemed a little offended that I complained of not sleeping well. Later in the day he told me that he had looked thru the cell and had found only ten or a dozen inhabitants, intimating that I ought not to have been disturbed by so small a matter. I assured him that the list of dead and missing was very large. With a view to keeping the prison clean, the Warden is planning to test steel walls and fittings. I can only hope he may succeed before my next visit. As it was, however, the incident served a useful purpose, for the news of it circulated thru the prison, and many of the men joked me about it, thus opening what often proved to be an interesting conversation.

There is, however, a serious phase of the problem of vermin that should receive careful investigation. This is the question of the extent to which disease may be carried by such agencies. As is well known, venereal disease is unusually common in a prison. If vermin carry such disease then the most stringent mesures should be taken against them.

The opportunities afforded the men for recreation are liberal and various. There is an auditorium, equipped with a moving

picture machine by the men themselves. A well-equipped library serves the purpose of both recreation and instruction. About three-fourths of the prisoners avail themselves of the privileges of the library, each one drawing on an average a book every five days, two-thirds of the books drawn being fiction. In the winter months the men conduct a debating society which is said to arouse much interest. Many of them are thoughtful, and are interested in the serious questions of the day; perhaps their experiences have tended to make them especially so, or it may merely be that the prison routine gives them time for thought which, on the outside, would be stifled by the distractions of everyday life. I found in conversation, however, that often the thinking painfully lacked guidance. One man in particular, of considerable mental keenness, had developed an ingenious cosmic and spiritual philosophy from sources unknown in academic circles. I think he gave me up as an impostor because I did not know this or that authority in theosophy or other pseudo-science. But to return to the subject of amusements, the interest in the summer months centers in baseball. The prison maintains a good team which plays match games with teams from Bismarck and from neighboring towns. This summer they played twenty-two games, winning thirteen. During my visit I had an opportunity to see one of the games with the Bismarck team. The game occurred in the prison yard on Sunday afternoon, shortly after the close of the religious exercises, and attracted a large crowd. The convicts played a snappy game which proved too much for their more righteous opponents. Perhaps the most interesting feature was the rooting of the convicts. It sounded a trifle incongruous to hear from a professional burglar: "O, you robber, you stole that; can't you play fair!"

In connection with the amusements of the prison the order day is worthy of mention. This occurs monthly and consists of the distribution of purchases that the men have made thru the agency of the office from outside sources. The packages are piled up behind an official table and distributed as the names are called, in a way that suggests a Sunday School Christmas exercise,—hence the nickname of "Christmas" that the men have applied to the occasion. Among the articles ordered tobacco, candy, and granulated sugar seemed to be the commonest. Strangely enough another favorite order was a certain much advertised brand of face cream, —probably used here less as an aid to beauty than to soothe chapped faces and hands. Valises were delivered to two inmates who soon were to be outside the walls in that alluring liberty which, how-

ever commonplace in fact, has the charm of a lost paradise to those who have been deprived of it.

A preaching service is held each Sunday after dinner, being conducted alternately by the catholic and the protestant chaplains. These ministers are appointed from the clergy of the town, as there is no resident chaplain. The Sunday I was present the service was conducted by a catholic bishop in the absence of Father M. J. Hiltner, one of the chaplains. I was surprised to hear how well the audience joined in the singing; they sang "Safe in the arms of Jesus" with real feeling and spirit. No doubt to many a man of apparently hardened nature the song awakened softening childhood memories. I happened to be at a church service in another place two or three weeks later where the same song was sung, but the dragging, half-hearted singing showed that it had little vital meaning to the self-righteous worshipers. The sermon delivered to the prisoners was well suited to the occasion. The bishop did not attempt to talk down to the men, as some make the mistake of doing, but discust sin and salvation in their universal aspects. As a substitute for the benediction the prison orchestra relieved the unwonted solemnity of the occasion by a lively, well-played two-step. Service at the chapel exercise is not compulsory, and there is no observable guard: a pleasing contrast to the scene in the old-time prison where unsympathetic preachers, and guards with loaded rifles, forced the gospel upon the helpless convicts.

Instruction in secular learning is not properly provided for by the state. That there is a need for it is shown by the fact that, as the Warden says, the men fairly beg for an opportunity to remedy the neglect of their education. Voluntary night schools have, however, been organized. This work was recently resumed for the winter with an enrollment of 68 men, or 27% of all. An effort is being made to secure a paid teacher, which if successful will materially increase the enrollment. Industrial education is also badly needed, particularly for the younger men. It would pay the state both in increased productivity and in decreased criminality: for discharged convicts are commonly tempted back into crime by the difficulties they encounter in making a living. But an ideal system could not be achieved quickly even tho the state should desire to inaugurate it. The present major industries of the penitentiary, —the twine plant and the brick yard,—are not based on the idea of training, except that of course they aid in establishing the habit of industry. They are based, rather, on the prospects of the greatest possible financial returns, and actually do render the prison

practically self supporting. Industrial training would demand a considerable variety of trades and occupations, such as could be practised on the outside, and these would be operated in many cases at a loss. The management of the penitentiary is keenly awake to this situation and appreciates the possibilities of improvement, but they cannot do much in advance of public opinion; and public opinion is at present far more alive to a slight increase in the tax rate than it is to the opportunity or advisability of reforming the criminal.

That the honor system is in force in the penitentiary of North Dakota is quickly seen by even the most casual observer. Besides the thirty or more men on parole in other parts of the state, there are men working outside the prison in barns, gardens, fields, and offices who are held by honor rather than by bars and walls. On making the acquaintance of these men one soon comes to realize that, as a class, they are worthy of the trust placed in them, and that the plan under which they work at partial liberty is in every sense just and wise. One, for example, is a man who committed murder under provocation, but who otherwise was moral and industrious. Apparently the criminal outbreak was in large part if not altogether the result of an accidental injury to his head in youth. The skull had been fractured and a metal plate had been inserted, but the operation had not been very skilfully performed. Comparatively recently he became subject to fainting spells, and it was evident that the old wound was giving trouble. Thru the kindness of the Governor it was arranged that he should be operated on again by an expert surgeon. The result is that now he is restored to perfect health. In the prison system his particular duty is the care of the poultry yards, in which he takes a keen interest. He was much grieved this season because he did not secure as large an output of young chickens as usual. His failure was due to climatic causes, but his disappointment could not have been greater if he had had a family dependent upon the success of his labors.

Another trusty who occupies a position of responsibility in the office is a young fellow of clean-cut business type. He is in no real sense a criminal. I was informed that he had been sentenced for embezzlement, but that the conditions under which the so-called crime was committed were such that blame lay primarily with unwise employers. As a young man he had been put in charge of a considerable business enterprise with the instructions to spare no expense in making it a success. He had made it a success, but his expenditures had been such as to leave him vulnerable to attack. The

excellence of his work in the penitentiary is attested by the fact that his bookkeeping was recently checked by the state examiner and pronounced exceptionally good. Still another trusty employed in the office is somewhat the same type of man. On the occasion of a cross country walk I had a long conversation with him, in the course of which he talked very intelligently on the control of the liquor traffic in the United States and Canada. As an illustration of the extent to which he has been trusted, it might be mentioned that during the winter the warden's son provided him with a gun and ammunition and took him out for a rabbit hunt several miles from the institution. It would have been entirely possible for the man, armed as he was, to escape, but he made no attempt.

Of course occasionally a man will be trusted who proves unworthy of the trust. A certain prisoner paroled last summer had won the confidence of all who came in contact with him, from the judge who pronounced the sentence to the officials of the penitentiary. He was regarded as exceptionally promising. Yet he had no sooner been placed on parole than he deliberately broke it under circumstances that showed he had been planning all along so to do. But such cases are relatively infrequent, and should not be taken as a condemnation of the system. Looking at the matter entirely from the standpoint of the safety of society, the few criminals who thus escape to continue, perhaps, a career of crime are more than offset by the many who by the parole system are thoroly reformed, but who under the older system would have been turned out at the expiration of their terms worse criminals than they had previously been. Besides, it is undoubtedly a fact that escapes are fewer from modern penitentiaries than from those that cling to the old harsh methods. The incentive to prove oneself worthy of parole is a strong element in prison discipline. It creates an atmosphere in which plots to escape do not thrive. Thus, on the whole, society is better safeguarded by the modern system than by former systems. In connection with the effect on public opinion among the convicts, it may be added that the feeling is very strong against the man who has broken his trust. Sometimes when an escaped trusty is recaptured and returned it is necessary to give him special protection to prevent the other men from injuring him. The prisoners naturally feel that the one who betrays his trust is doing so much toward bringing into disrepute and perhaps discontinuance a system that serves their own best interests. Needless to say the formation of a prison public opinion in favor of conformity to law is an influential factor in reforming the criminal.

Escapes from the penitentiary are naturally infrequent. The difficulties and inducements checking the attempt are many. Yet in spite of all, escapes sometimes occur. In such an event a warning whistle is blown, and a pursuit begun. For this purpose bloodhounds are kept in training under the charge of an officer who has had experience in such work.

Parenthetically I might say that I found it an interesting experience to go ahead of the dogs when they were taken out for training. Prepared for a long hike, two trusties and I started one afternoon for the low bluffs that border the Missouri valley a mile or two to the rear of the penitentiary. We were allowed a start of an hour or more before the dogs were set on our trail. We took an irregular course thru some low-lying ground, traversed a long ravine that brought us to the top of the bluffs, and then turned and followed the line of the bluffs to the north. We could hear the baying of the dogs some time before they came into sight. When at last we saw them it was interesting to observe how accurately and easily they followed the trail. With heads up they came at full speed, yet they followed as far as we could tell every detour in our course. A long way in the rear came a horseman with one of the older dogs to guide him in case the other dogs were lost to sight. Needless to say, if we had been criminals attempting an escape, we should not have got very far on that occasion.

When the dogs trail a runaway they usually, on coming up, circle about him until the horsemen arrive on the scene; rarely they will attack the man. When they attack they may be worsted, as happened once when one of the dogs was killed and others badly injured by two escaped men who had armed themselves with knives. Sometimes the runaway succeeds in evading the dogs by jumping a freight train, or riding a long distance with some passing rig, but even under these circumstances the dogs may strike the trail again. In one recent attempt a clever ruse was used which threw the dogs off. Two men having planned to escape put on overshoes that had been soaked in a disinfectant provided for use in the stables. They then secured access in some way to a guard tower, where they overpowered and gagged the guard, and made good their escape. The dogs could not pick up their trail and the attempt might have succeeded but for the fact that the men were by chance recognized later at the home of the farmer with whom they had obtained employment. Often some trifling chance like this results in a return of the fugitive, as in the recent case where a man had made his "getaway," but was picked out quite by accident from a hobo gang in another part of

the state by the fact that he had forgotten to remove the prison number-tag attached to his shirt.

The complexities of the problems of prison management arise largely from the fact that prisoners represent so many different personalities and classes. Of course one may theoretically speak of the criminal type; referring to statistics, for example, one finds that in our state the typical criminal is a young man of twenty-five or thirty years of age, of American parentage, has little education and no skilled trade, is intemperate, is unmarried and without close ties of kindred, being commonly a transient. Yet such a statistical average is worse than useless unless we bear in mind the fact that exceptions outnumber the rule. Somewhat more satisfactory is the classification of criminals into more or less clearly marked groups. In discussing the problems of dealing with convicts, this plan will be followed.

Accidental criminals constitute a very large proportion of all convicts, as may be inferred from the descriptions of trusties already given. By accidental criminal is meant a man of not predominantly criminal bent who has yielded to some sudden strong temptation, but who under normal conditions would presumably have remained a good citizen. A typical case is that of a fairly steady young workman who while under the influence of liquor takes a dare to hold up a passerby. The act is without real motive, it results in the theft of only an insignificant sum, but it brings the offender to the penitentiary. Or it may be the case of a transient, a mere youth, who has lately cut loose from the influences of home. He works at various jobs for short terms only. At one time work is hard to get and he has not prepared himself for a period of unemployment. His needs press more and more heavily until one night he breaks into a store. Or it may be the case of a steady, reliable fellow who after working a long time for a miserly farmer is refused pay on various pretexts. Entirely ignorant that he might have had recourse to law, he begins to quarrel with his employer and at last in a rage picks up a neck-yoke and strikes blindly. Now as a murderer he is serving almost a life sentence. The crime in so many of these cases results from the fact that the man has broken loose from the natural family and neighborhood ties of acquaintance and personal interest that, after all, are the main socializing agencies. Without these bonds that bring responsibility and counsel a man follows the same inherent tendencies that made primitive peoples prey upon the stranger. The reason why the parole system is so successful in dealing with such cases is not so much that it holds out a threat of further punishment

as that it provides the personal touch capable of awakening the sense of responsibility. It is the first step in reweaving the mesh of associations that hold the individual in harmony with his fellows.

Since liquor as a cause of crime has just been mentioned, it may be remarked in passing that many convicts from the transient class ascribe their downfall, not so much to drinking in general, as to the strenuous qualities of our prohibition whiskey in particular. One man told me: "You would commit crime yourself if you had to fill up on bootlegger dope."

Occasionally the so-called accidental criminal is one who without the least criminal intent has chanced to come within the clutches of the law. As an illustration I may mention the case of a young Russian whom I happened to sit next to at the table during the few meals I ate with the men. He appeared to be so decent and well-behaved that I became interested in him and inquired as to his history. I learned that he had been sent up for a short term for attacking a man. The quarrel had arisen at a neighborhood dance. It often occurs at these country dances that fighting is started, usually by some rowdy who wants to break up the festivities. On the occasion of the fight in question a bully had appeared on the scene looking for trouble. The young Russian tho a small man attacked him, and all too successfully, it seems, in the opinion of the court. It happened that previously the authorities had decided to take active mesures to break up the fighting at the dances. The case was therefore dragged into the courts, and the young Russian, technically guilty of starting the fight, received a penitentiary sentence, tho to the lay mind it would seem that he should have been commended and appointed to succeed the officer who apprehended him. The crop which he had sown in the spring was left thru the summer without care. His wife, expecting soon the advent of the first child, was left alone to manage the farm as best she could. Fortunately the parole board was legally able to act upon the case in the late summer and the man was sent out in time to harvest his crop and to care for his family. I had the pleasure with others of shaking his hand and congratulating him on his parole as the prison bars swung open to him.

Such a case as the foregoing suggests the possibility of innocent men being convicted and punished. Many claims of such treatment are made by convicts, but of course conclusive evidence is usually lacking, and the presumption is that justice has not miscarried. One case, however, was being acted upon by the parole board at the time of my visit in which it had been satisfactorily proved that a man convicted of rape was the victim of a conspiracy. A similar case of

which I was told was that of an industrious and steady negro who had been made the scapegoat for the sins of some young rakes. He served a year or two before medical testimony absolutely proved his innocence. Still another case of recent date came to my attention in which there was somewhat convincing evidence that a man had been sentenced for burglary because he happened to be in the company of a thief. Apparently one conviction was not enough to satisfy the authorities, or to sustain their reputation as guardians of the public peace, so they railroaded thru the next man just by way of good mesure. The victim was a young laborer come into the state for the fall work. The usual attitude toward the class to which he belongs is indicated by the reply of a gentleman to whom I related the case. "What difference does it make," he said, "those fellows all deserve punishment, anyway." But it may be said in rejoinder that it makes some difference to the respect for law prevalent among the classes that are victimized by such indiscriminate methods.

From accidental criminal to habitual criminal is not a very long step, and one that is fatally easy to take. It is notoriously difficult for the ex-convict to establish himself. The public is suspicious, prejudice is strong, and a criminal record proves a heavy handicap. Even after a thoro reformation—and many such do occur—the ghost of the past will arise to undo a re-established career. I talked with a man in the penitentiary whose story, later verified, will illustrate the difficulties attending reformation. He had been a professional burglar. After a time, however, he decided to abandon a criminal career, and settled down to steady work by which he was supporting himself and an aged mother. By chance a detective of the type unfortunately too common today came into the town where the man had settled, and recognized him. Thinking it a good chance to distinguish himself, the detective attacked the ex-convict and then arrested him on the charge of resisting an officer. So the man was sent back to the penitentiary to serve another sentence while the aged mother was thrown upon charity. Another somewhat similar case occurred recently. A former convict who had escaped before completing his term of imprisonment obtained employment in Montana on the railroads. He became a steady worker, was gradually promoted, married, and lived an honest life for several years, supporting his family. Finally some one discovered him. He was brought back to the penitentiary to serve out the remainder of his term. After several months of imprisonment parole was contemplated, and the prison officers wrote to the railroad to know if the man would be given back his former position. The reply was a refusal. Thus the return to prison

had resulted in the loss of a position for himself and his family that could be regained—if regained at all—only after much laborious climbing.

This case awakened a good deal of interest among the convicts, and one of them exprest their point of view in these words: "If punishment is really for the purpose of reformation, then the fact that D—— had made good should have counted in his favor, and he should not have been sent back." The position was logical in view of the modern attitude toward punishment, but for the other side it is to be said that under a lenient system of discipline escapes must be strictly dealt with. But if it had not been for the inflexibility of legal processes doubtless a compromise might have been made by which justice could have been satisfied without jeopardizing the new character that had grown from the soil of productive labor, steadied by the ties of domestic and parental affection. One is reminded of the incident that William Allan Pinkerton relates from his wide experiences with criminals. He can tell of many reformations, even of men who would be classified as instinctive criminals, and has always done what he could to further them. On one occasion he followed the trail of a long-sought fugitive from justice into a remote city of the far East. Inquiring as to the man's whereabouts, he learned that the former criminal was now established in business and was living a blameless life. A little later he unexpectedly came face to face with the man. Each recognized the other instantly: the former criminal cringed before the fate that seemed impending, but the great detective feigned not to know him and passed by, giving up the quest that had brought him to the place.

In extreme cases where crime has become habitual from early childhood it seems hopeless to expect a reformation. A case of this sort was presented to the parole board recently. A young man of about twenty-four, somewhat undersized but fairly intelligent in appearance, had been sentenced for the theft of a livery team. Before the parole board he told his story without apparent shame. He had been born and reared in a house of prostitution where vice and "dope" had become a part of his life. His only occupation had been that of acting as the so-called cadet for the white slave traffic. His presence in the rural portions of this state is, by the way, a sinister indication of the ramifications of that nefarious business. Naturally he was not granted a parole, but in the usual course of things he will be released, in all probability to go back to the old ways. How much wiser would be the indeterminate sentence under which the authorities could restrain such a man in the reasonable discipline of the

penitentiary, permanently if necessary, or until such time as he could be considered reformed, and could supervise him after release until he had proved his reformation was genuine.

The instinctive criminal is not easy to identify in a brief study, hence I am not able to illustrate this class very satisfactorily. I met one man, however, who enjoys some notoriety as a "bad man" and who is regarded by the authorities who came in contact with him as instinctively criminal. It was said of him that it took several men to drag him into the court room for trial, and that when aroused in anger the hair on his head literally stood erect. In the prison the officials considered that they could not safely allow him to work with the other men. On more than one occasion they had had difficulty with him, and finally had thrown him into solitary confinement where he had been for several months. Sometimes when in a rage he had smashed the meager furniture of his cell and banged the iron cover of the pail against the bars of the door until the corridors resounded. Once they overpowered him and handcuffed him to the steel bars of his cell door, but a few minutes later he threw out the handcuffs to an astonished officer asking him to take them to the warden with his compliments. It appeared that he had removed the handcuffs by a trick which had been a part of his former stock-in-trade. He had followed the circuses for years, and had been with one of the well-known shows around the world. Professionally he had been known as the handcuff king. As I happened to visit him about noon, he hospitably invited me to take dinner with him. I accepted, and an officer saw me safely behind the bars, after which dinner was brought us by the retired horsethief who was acting as attendant. The meal was put up in individual trays containing a good quantity and variety of food. After so favorable an introduction we had a long and interesting interview. He talked freely of his early life and experiences. He also asked my help in writing a description of some handcuffs which he had invented and of which he had made a most ingenious model. These were so designed as to be proof against being opened by any other means than the key. He explained the simple device he had used to open the style of handcuffs now in general use, and claimed that when his patent is put on the market it will displace the other. So far as I could judge from this interview, and from the testimony of those who have dealt with him, he is not abnormal. I doubt that this type of person should be regarded as instinctively criminal. It is quite easy to conceive how a person of superior physical strength, brought up without restraint, and accustomed to a wild, free life, should stubbornly resist the discipline of the prison. There

is a further strong motive in the continuance of such a course once begun in that in the underworld a reputation for hardihood is coveted, and when once gained must be lived up to. It is likely that, better understood, the so-called instinctive criminal would prove not so essentially different from human nature in general. At least so keen an observer as Pinkerton claimed that "the criminal is just like other folks."

There is a type of criminal, however, that is congenitally a variant below the average of normal humanity, and what is true of this type is often true in lesser degrees of other criminals. This type is the feeble-minded. That feeble-mindedness in a mild form is a fairly common cause of crime as well as of other forms of degeneracy must certainly be conceded. It is difficult to put the matter into exact figures, but judging by recent observations it seems fair to assume that probably one quarter of all criminals are such not because they have necessarily more of criminal impulses than others, or because they have had an evil environment, but rather because they are naturally incapable of adjusting themselves satisfactorily to the ordinary pursuits and motives of life. Some say that a large majority of criminals are of this type. One must take guardedly, however, the results of psychological tests supposed to reveal innate mental deficiency. It is impossible clearly to separate the inherited factors from the results of experience in individual instances. But making all due allowance there undoubtedly are many cases of inherited mental defect to which criminality must be charged. Such cases come from a fairly large subnormal population,—originating in greater or less ratio in all social classes,—over whom society must eventually exercise such supervision as is necessary to keep them from the miseries into which they plunge themselves and those connected with them, as well as to prevent their undue increase.

As time goes on there will unquestionably be a great increase in the institutions providing a mild industrial discipline in which may be segregated those persons whose mentality is insufficient to carry them thru the obstacles of everyday life. Farms for inebriates, labor colonies for the unemployed, convict camps, and other plans will restrain in useful segregation the misfits of society, where they may live in reasonable comfort, achieving such economic production as they are capable of, but ending with themselves an otherwise rapidly increasing stock. Such institutions will almost pay their way, and the saving they will effect in the future removal of poverty, crime, and inefficiency is incalculable. A number of men of the type that could be cared for in this way may be met in the penitentiary, where,

tho their labor is more than paying the state for their support, they are obliged to bear the stigma of the prison and the association with some who are really degenerate. One such man, a good workman under supervision, was recently released from the penitentiary at the expiration of his term. He soon found, however, that he could not adjust himself to the life outside, so he openly stole a coat on display in front of a city store and thus earned his way back into the institution where he felt at home.

Warden Wolfer of Minnesota tells of a similar case that came under his observation. A negro ex-convict, wishing to return to the penitentiary, stole some jewelry. At the trial the value of the jewelry was estimated at a little under twenty-five dollars, a sum sufficient to call for a sentence only to the county jail. In consternation the prisoner pleaded: "Raise the price boss; can't you raise the price?" Grasping the situation the officers raised the price to the required twenty-five dollars and the prisoner gained his reinstatement in the penitentiary.

Just as feeble-mindedness is often associated with crime, so insanity in greater or less degree is a predisposing cause. The number of cases of criminal insane in the charge of the state at present is not large, but there are enough to demand, if not a separate institution, at least a separate department at the penitentiary for their care. Such men cannot safely be handled with the others. Quite recently a man of this type committed suicide with a razor that he had managed to steal while waiting his turn at the prison barber shop. That a still more serious tragedy was barely averted seems evident from the fact that the man, just before committing the deed, was looking for one of the officers against whom he had a grudge. The chance absence of this officer was probably all that saved him from a murderous assault.

It is, of course, the defectives,—the subnormal or the deranged,—who perpetrate the fiendish and unnatural crimes that occasionally shock the public. The feeling of horror and resentment aroused against such criminals is natural, but when one has talked with such a moral pervert and heard him prattle like a child of the impossibilities he expects to achieve, the horror changes to amazement that society has not prevented such crime by caring in institutions for these children with adult passions and physique.

A number of cases were brought to my attention of which the following may be taken as a type. The story was told me by the young fellow involved, and was substantiated later by other inquiries. I do not recall what the crime was, but it was not on the face of

it a serious one, nor was the man an habitual criminal. After his arrest he was visited by the state's attorney and urged to confess. It was made to appear to him that if he would only sign a confession he would be saved the long wait in an abominable county jail and would receive only the minimum sentence of a year, which with good behavior would be commuted to seven or eight months. Trusting the word of the attorney he signed the offered confession, only to find later that he had confest to a crime in a higher degree than could have actually been proved against him, and that he was facing a term of several years' imprisonment. Of course the motive of the attorney was apparent. The better reputation he could make in the way of securing convictions, the stronger appeal he could urge to his constituency when he should come up for re-election. That he had ruined a man who might otherwise have been easily reformed—had probably made him a permanent enemy to society—was nothing to the young lawyer with a reputation and a place to make. I think I have never seen depicted on a man's face such an intensity of bitterness as on this convict's as he related the way he had been tricked. I was told by a prison official who has had a wide experience thru the state that such cases are fairly common, and that sometimes it is probable that innocent men, caught in a net of circumstantial evidence, are frightened into making actually a false confession by similar misrepresentation. Aside from the direct injustice involved there is a further evil in the practise in that when the parole board wishes later to investigate the case there is in existence no official evidence for them to consult, and the confession must be taken at its face value.

After all that has been said, perhaps it is unnecessary to add that the present management of the penitentiary is both humane and efficient. The state is fortunate in having at the head of the institution a man of broad education and outlook, fully in touch with forward movements elsewhere. The tact and sympathy with which he has dealt with the men under his charge were fully attested by the men themselves. It is hoped that this paper may have set forth at least the salient features of the program now either actually in effect or in the initial stages,—the parole, the indeterminate sentence, the honor system, humane discipline, industrial training,—and may suggest the eventual abandonment of walls and barred cells for the majority of criminals and the adoption of the farm or labor colony plan. Broadly stated it may be said that society is passing out of the purely instinctive attitude of revenge, and is approaching an intelligent study of the criminal. It has been found that most criminals

who come under institutional care require firm guidance rather than blows, training rather than punishment, understanding rather than hatred; and that in the long run intelligent kindliness is more efficient than instinctive hate in gaining the end of social safety. As to the public at large, it has an essential duty to perform in forwarding the new order of things. For while details must be worked out by officers and boards of control, the broad outlines and the limitations of a policy will be determined by public opinion, the motive power of all executive machinery.

Insanity in North Dakota

JOHN MORRIS GILLETTE, *Professor of Sociology*, HARVEY ELLSWORTH FRENCH, *Dean of the School of Medicine*, and GEORGE R. DAVIES, *Assistant Professor of Sociology, University of North Dakota*

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THIS article embodies a study of insanity in North Dakota. The object is to exhibit the essential facts pertaining to it and to discover the tendencies at work with the hope of being able to suggest ways of handling the situation in a helpful manner. All are agreed that insanity, being both a misfortue and a menace, should be checked and prevented so far as possible. It is therefore assumed that responsible state agents, whether administrative or legislative, desire all the light they can get that bears on the situation. The writers do not pretend to deal with the subject exhaustively, merely to present the salient features. They write from the

viewpoint of citizens of the state who possess some knowledge of the subject and who have given it careful thought.

INCREASE OF INSANITY IN NORTH DAKOTA

I. Increase in the Past

If North Dakota is to provide adequately for her insane, she must know what to expect. Our policy for this year and for ten years hence, as to the number of hospitals and as to the extent of equipment, must be shaped in large mesure by the number to be provided for. These questions must be met: is insanity increasing? and what will be its rate of increase in the future?

§ 1. Rate of Increase. There has been an actual increase of insanity in the state as shown in the following statements. In all probability there are a few insane in the jails, in the county homes for the poor, and in private homes, but we have no statistical reports covering these fields so must go to the State Hospital alone for statistics of actual growth. In 1890 there were 221 inmates; in 1900, 383; in1910, 653, and on October 28, 1914, 925.[1] This is an increase of 318.5 per cent in about 24.3 years. This represents the actual increase in numbers. Has there also been a relative increase? This can be answered only by comparing the growth of insanity in the state with increase in the state's population. The accompanying table embodies such a comparison:

Table I
Comparative Population and Insanity Increase in North Dakota[2]

Year	Population		Insanity	
	Number	Per cent of increase	Number	Per cent of increase
1880	36,909			
1890	190,983	417.4	221 (June 30)	
1900	319,146	67.1	383	73.3
1910	577,056	80 8	653	70.4
1914 (Nov. 1)	802,107 (estimated)	39.0	925 (Oct. 28)	41.6
1890-1910	- - - -	202.2	- - -	195.4
1890-1914 (Nov. 1)	- - - -	319.9	- - -	318.5

1. Biennial Reports of State Hospital for the Insane; First Biennial Report of State Board of Control p. 110; Statement received in letter from Mr. W. M. Hotchkiss, Superintendent State Hospital for Insane.
2. Biennial Reports of State Hospital for Insane; Letter from Mr. W. M. Hotchkiss; North Dakota Blue Book, 1913, p. 400.

According to this table it is apparent that insanity-increase and population-increase have kept about even pace. Whether this relation will continue, depends upon conditions to be discust later. Note that insanity has made large strides since 1910, increasing 41.6 per cent in four and one-third years.

II. Probable Increase in the Future

Careful provision for insanity in the state must be made with a view to its future growth. Shall we expect the same increase as in the past, or a larger or smaller gain? A reply to this question is conditioned by several considerations:

§ 2. Biennial Gains and Losses. First, what light is thrown on it by an analysis of the records of biennial gains and losses in the inmates of the State Hospital? Table II is constructed from the facts given in the First Biennial Report of the State Board of Control:[3]

Table II

Biennial Increase of Inmates—State Hospital

Year	Admitted (including readmissions)	Discharged and died	Net gain
Dec. 1, 1886	176	46	130
Dec. 1, 1888	180	155	25
Oct. 31, 1890	186	121	65
June 30, 1892	186	145	41
1894	247	188	59
1896	152	145	7
1898	233	208	25
1900	279	226	53
1902	300	229	71
1904	327	319	8
1906	381	357	24
1908	418	328	90
1910	458	354	104
1912	424	230	194

An inspection of the column headed "net gain" gives the impression that since 1908 insanity has made unusually rapid strides. Are those gains normal, that is, are they in line with the tendencies in the past? To answer this question is must be noted that since 1906 the number of inmates "discharged and died" is proportionately below the number up to that time. Down to 1898 the biennial admissions were between 100 and 200, with one exception, and so were the biennial "discharged and died," except for the first period. Between 1898 and 1908 the number for both items ranged from 200 to 400, the "discharged and died" following closely after the admissions. But after 1906, while the admissions rose above 400,

3. First Biennial Report, State Board of Control, p. 117.

the "discharged and died" remained nearer 300 and in 1912 fell to 230. Thus the "net gains" since 1906 have unduly increased. On the face of it there is no reason why the State Hospital should cease to lose the same proportionate number of patients by death and discharge. And this decided increase may prove to be temporary.[4]

§ 3. Import of Insanity in the Nation. What import has the status of insanity in the nation at large for North Dakota? The rate of increase of inmates in state and private hospitals of the United States and of insane enumerated for the various periods indicated was as follows: June 1, 1880, to June 1, 1890, 80.7 per cent; June 1, 1890 to December 31, 1903, a period of 13 years and 7 months, 114.4 per cent; December 31, 1903, to January 31, 1910, a period of 6 years and 1 month, 25 per cent. The per cent of increase between 1890 and 1910 was 140. The rate for North Dakota in the same time was 195.4 per cent.

But it must be remembered that the census of 1880 and 1890 comprised great numbers of insane persons outside of hospitals, while that of 1903 was by law confined to inmates of such institutions. This would have the effect of increasing the rate of increase assigned to 1903.[5] It is also evident, when we consider the history of hospitals in the nation, that there has been no such increase of insanity in the United States at large as the statistics of growth seem to indicate. There are several reasons for this statement, some of which bear on the situation in North Dakota. First, the hospital method of caring for the insane is a very recent thing. Thus between 1890 and 1902, 192 hospitals, 114 of which were state and county and 78 private, were either established or reported for the first time. Before the hospital era, the recent period of multiplication of hospitals, insane persons were scattered in poor houses, jails, and thruout the population generally. Then cities, and especially states, seeing the necessity of social protection, began to establish hospitals for their care. As a consequence multitudes of unknown insane persons were discovered, placed in such institutions, and enumerated for the first time.

Second, since hospitals are new enterprises and bring a better condition and regime for the conduct of the life of the insane, such persons live longer than previously. Hence, instead of relieving the situation by early death, they remain alive to swell institutional populations. Both of these factors have appeared also in England and altho the statistical growth of insanity would appear to demon-

4. Ibid.
5. United States Report on Insane and Feeble-minded, 1904, pp. 6-9; United States Statistical Abstract, 1913, p. 59.

strate that that nation has been going mad very rapidly, careful students of the subject believe that the increase is only seeming and that when the new system is older the effect of the strong currents towards the hospitals and their congestion will be reduced.

Third, the average expectation of life has been raised from 35.5 years in 1789 to 45.4 years in 1900. Since 61 per cent of all first admissions to hospitals are more than 35.5 years of age it is obvious that lengthened life throws a greater number of insane into hospitals. This would be greater for rural populations than for urban, since there is a greater proportion of persons 55 years of age and over in the former.

Fourth, improved hospital care is inducing the insane to enter earlier. While in England during the years 1876-1880 only about 66 per cent of patients were admitted to hospitals during their first attack, in 1900 the proportion had risen to 85 per cent, and fifth, a greater number of insanities are now recognized with a consequent enlargement of populations of hospitals for insane.[6]

§ 4. Import of Insanity in Other States. How does the record of North Dakota compare with that of other states? To meet this question a choice has been made of states representing various portions of the nation, including the states adjoining North Dakota. Table IV represents the record of each state, thus chosen, since 1890:

Table III

Ratio of Insanity to Population in Certain States, 1890, 1903, 1910[7]

State	One insane person for the given numbers of population		
	June 1, 1890	December 31, 1903	January 31, 1910
Alabama	1402	1210	1048
Arkansas	2899	2066	1441
California	367	260	357
Connecticut	479	341	311
Minnesota	700	469	437
Montana	768	514	539
New York	446	295	291
North Dakota	913	818	919
South Dakota	1416	706	675

6. Publication No. 1, National Committee for Mental Hygiene, New York, 1912; Sociological Review, London, 1913. Volume VI, p. 8; United States Report on Insane and Feeble-minded, 1903, pp. 4-5; United States Statistical Abstract, 1910, p. 129.

7. Constructed from data given in United States Statistical Abstract, 1913, p. 59.

This table shows, for example, that in 1890 Alabama had one insane person in her hospitals for every 1492 inhabitants of the state; in 1903, one for each 1210; and in 1910, one for each 1048. The majority of these states evince a heavy increase within the period. Two of them, California and North Dakota, show but slight increase. From this showing it is apparent that North Dakota has a much lower insanity rate than Eastern and Northern states. For instance, if, in 1910, she had had the ratio of New York, instead of having 653 inmates she would have had 1983. Had it been the Minnesota rate, the number would have been 1320. How is the lower rate to be explained? Will it continue to prevail or are there influences at work that are likely to cause it to increase?

CONDITIONS AFFECTING THE GROWTH OF INSANITY

Some of the more important causes and stimulating conditions of insanity are urbanization, immigration, alcoholism, venereal diseases, and heredity. These factors are not mutually exclusive and it is possible to assign to them only their approximate force in the production of insanity. How far do these predisposing conditions obtain in North Dakota?

§ 5. Urbanization. Urbanization in itself is not a direct cause of insanity, but it gives rise to conditions which in turn are provocative. It is found that immigration predominately settles in cities; that cities are conducive to the use of alcoholic drinks; that they foster vice and venereal diseases; and that they subject their inhabitants to abnormal nerve strain and mental worries. The presumption is that urbanization means increased mental disorders. No doubt much of North Dakota's comparative exemption from insanity hitherto has arisen from its rural nature. On the other hand it is certain that we must expect a growth of cities and as a consequence a relative decline of country population. Evidently this means that we must look for a comparatively greater increase of insanity, other things being equal. However, there is consolation in the fact that cities develop slowly and that the state has, therefore, time to adopt checking methods.

§ 6. Immigration. Immigration is doubtless a contributing cause of insanity. This ensues, not because many insane are admitted at immigration ports, for such persons are supposedly excluded. It comes from immigrant stocks with hereditable insanity, or because of the strains and shocks arising from the adjustments immigrants

are forced to make in a strange country. "That immigration is an important source of insanity in the United States is shown by the fact that altho the foreign-born constitute but 14.3 per cent of the general population, the foreign-born insane constitute nearly 30 per cent of the insane in institutions, and this, too, despite the fact that all ages are not represented in the foreign-born population, as in the case of the native born."[8] But since insanity is essentially an adult disease and since our foreign-born inhabitants are largely adults, their showing is not as bad as the figures indicate. Were they more largely children, the percentage among them would be less.

The record of the North Dakota Hospital for the Insane shows that during the biennial period, 1910-1912, there were 211 foreign-born persons admitted, 194 native-born Americans, and 19 of unknown origin.[9] But in 1910, 72.9 per cent of the population of the state were native-born Americans, and but 27.1 per cent were foreign-born. Thus a little more than one-fourth of the population is producing over one-half of the state's insane.

At the close of the present European War there is likely to be an abnormal increase of immigration to this country. Three courses are open to the nation and to this state. First, the nation should insist on a rigid enforcement of the laws excluding all mental defectives. Second, it should pass laws which will prevent wholesale immigration. Third, the State should cease to engage in a campaign of advertisement to draw immigrants to North Dakota. This is chiefly a real estate proposition backed up by state funds. In the long run North Dakota will lose more by breaking down its stock of population than it will gain as a result of added population.

§ 7. Alcoholism. That the use of alcoholic drinks, including beer, is a cause of insanity is being made clear today. It is estimated that at least 25 per cent of mental disorders are produced directly and indirectly by intemperance. In 1911, of the 5,700 cases admitted to the New York State Hospitals "13 per cent of the men and 3 per cent of the women were intemperate in their habits; 22.9 per cent of the male admissions and 8.2 per cent of the female, a total of 911 cases, or 16 per cent in all, were directly attributable to alcoholism."[10] In 24.3 per cent of all cases admitted alcohol appeared as a habit disorder, or causal factor. In 1910, of the new cases appearing for admission in the state, 15.7 per cent of males and

8. Publication No. 1 of the National Committee for Mental Hygiene, New York, 1912, p. 13.
9. Biennial Report, State Board of Control, 1912, p. 112.
10. Proceedings of the Mental Hygiene Conference and Exhibit, New York, 1912, p. 18.

3.9 per cent of females were cases of alcoholic insanity."[11] Should we consider, further, that alcoholism fosters weakly children, feeble-mindedness, vice out of which arise venereal diseases, pauperism, and other pathological conditions, and that out of such conditions is produced much of the insanity thru inherited defects, we would be forced to lay a much larger portion of insanity at the door of alcohol.

Altho North Dakota is a prohibition state, it is a well known fact that there is much liquor consumed, sufficient in amount to be productive of conditions out of which mental ailments arise. A more rigid enforcement of our laws would decrease the amount. The state could also do much to further scientific temperance teaching in the schools, and lastly it should set its face resolutely against the repeal of prohibition.

§ 8. Venereal Diseases. Venereal diseases are prominent and contributing factors in breaking down the human stock. They generate many kinds of hereditary physical defects which operate to produce mental defectives. Syphilis, in particular, frequently imposes on its victims that form of mental disorder known as paresis, a disease commonly regarded as incurable. The large causal influence of syphilis in producing incurable insanity is seen in the facts obtained from the New York State Hospitals. In 1911, of the 5,700 new cases admitted to those institutions, 18 per cent of the men and 7.5 per cent of the women were cases of general paresis. Paresis furnishes a greater proportion of insane patients to the New York hospitals than does any other form of insanity. But this does not represent the whole situation in New York, since many cases of paresis are sent to private institutions, many remain at home, and some die in general hospitals.

Paresis is a prolific cause of hereditary mental defects. In one instance, out of 100 children whose parents had paresis 45 per cent were damaged physically, 9 per cent, mentally, and one-third had the syphilitic poison in their systems. In another case, out of 139 children descended from parents having syphilitic nervous disorders, over 25 per cent were feebleminded or had a serious nervous disorder. In another case a son of a syphilitic mother had juvenile paresis, two other children were feeble-minded with hereditary syphilis, and a fourth had syphilitic skin disease.[12]

The reports of our State Hospital for the Insane throw but little light on the extent of paresis in North Dakota, since there are given as causes of insanity only those directly operative at the time

11. Report of the New York State Board of Lunacy, 1911.
12. Report of the Mental Hygiene Congress, New York, 1912, pp. 17-18, and 62-70.

of commitment. This is, of course, a loose, inadequate, and unscientific mode of designation, and renders it impossible to determine the causative influence of any such disease as paresis. If paresis is having as great an influence in causing insanity in North Dakota as in New York, 60 of the 424 cases admitted in 1910-1912 should have been so assigned, whereas there were but 7. But it probably has not the same influence, since it is an urban disease, and North Dakota has a rural population. That it is a disease of the city is seen in the State of New York in the fact that its prevalence among city men is nearly three times, and among city women twice, as great as among men and women from the country districts.[13] But that there is widespread syphilis in the state can not be doubted. The medical practitioners in both small and large towns admit it. As cities multiply and grow we must expect more rather than less of venereal diseases unless there should be an awakened conscience which works against all conditions making for prostitution and vice. As in all other phases of insanity what the state is to become is dependent upon the methods and programs adopted.

§ 9. Heredity. A very large portion of insane disorders are the product of hereditary factors. Reverting to the state hospitals of New York it is found that for the year 1911, of the 5,700 admissions, so far as definite information was available, "27.7 per cent of the cases showed a history of insanity in the family . . . 29.9 per cent showed a history of nervous diseases, alcoholism, etc." These constituted a total of 57.6 per cent of all cases admitted. The medical director of the psychopathic hospital located at Ann Arbor, Michigan, has found that "64 per cent of the patients had among their ancestors or families either insanity, apoplexy, paralysis, psychopathic abnormalities, or chronic alcoholism."[14] Since insanity may arise in the progeny of mental defectives, the presence of feeble-minded persons in the population at large is a prolific cause. It is estimated that there are more than 300,000 feeble-minded in the United States, 1 for every 300 persons. So reckoned in North Dakota, with its population of approximately 800,000 we would have some 2,666 feeble-minded. For the nation at large but 7.5 per cent are segregated in institutions. In this state, according to the 1912 report of the institution for the feeble-minded, there were 169 persons of this type segregated, only about 6.3 per cent. That North

13. Ibid, p. 67.
14. Proceedings of the National Mental Hygiene Conference, New York, 1912, p. 18; National Conference of Charities and Corrections, 1911, p. 453.

Dakota is sowing the seeds of disaster is quite evident.[15] So long as the state permits mental defectives of all kinds to breed, there is little doubt that there will be a great multiplication of defectives. An instance given the writer by Superintendent Hotchkiss of the State Hospital illustrates this. The hospital confines five insane children and their two insane parents. These five children have themselves 60 or 65 children in the state outside the hospital. It is only a question of time until many of these will knock for admission. The Minnesota State Agent for paroled insane women states that Minnesota has multitudes of ex-inmates of the state hospitals who have married and borne children. To twenty such women—only a part of such in the state—have been borne 116 children, many of whom are backward mentally or insane. One woman had five children, the oldest an idiot. How insanity interlocks with other pathological factors is seen in the case of this women. Her mother was insane, three aunts died with cancer, and her father was a heavy drinker and a confirmed morphine user. In another case a woman who had been insane seven years and paroled within a year, had given birth to ten children five of whom were born since she became insane. Teachers report that the children who enter school can not be taught. She has, in all probability, imposed upon them not only an hereditary taint, but an undeveloped life as well.[16]

When it is remembered that both insane and feeble-minded persons may produce children of either type of mental defects, and that North Dakota has as yet done little to prevent the insane who have been partially restored and the feeble-minded to propagate, it becomes obvious that we must expect an increase of insanity from these sources.

SUGGESTED PROGRAM FOR NORTH DAKOTA RELATIVE TO INSANITY

I. Justification of a Program of Prevention

§ 10. The Method of Prevention. In a fully civilized state it should be unnecessary to plead for a policy of prevention in dealing with any of our defective classes. It should be sufficient to remind ourselves that the only effective course of action is one which, with the causes of the evil understood, seeks to eliminate the evil by removing the cause. Every science and practical art seeks to use the preventive or causal method. It is the method which the prac-

15. Proceedings of the National Conference of Charities and Corrections, 1911, p. 2; First Biennial Report of the State Board of Control, North Dakota, p. 155.

16. Fifth Biennial Report of the State Board of Control, Minnesota, p. 219.

tical and scientific farmer seeks to carry out on the farm. If rust preys upon the wheat, the seed wheat is dipt in a germicide solution, or a rust-resistant wheat is resorted to. Medicine is becoming more and more preventive and causal. Doctoring patients by treating the symptoms of their diseases is decidedly antiquated. Bacteriologists are on the hunt for the germs which produce the various diseases. Thus the bacteria producing diptheria, tuberculosis, and typhoid fever have been discovered and effective anti-toxins for all save tuberculosis have been provided.

In social matters the same principles and methods prevail. There is more science at the bottom of reform than the average man is able to conceive. The causes of many of the evils of society are known, and approximately accurate methods of relief can be prescribed. The great impediment to progress in this direction is ignorance. Genuine statesmanship consists in the recognition of the grounds and causes of social evils and in the establishment of laws and institution which will successfully combat the evils by treating the causes. Insanity is a social evil. It is the product of fairly well defined causes as has been seen. These causes include urbanization with its abnormal stress and worry; immigration with its defective stocks and difficulties of readjustments; alcoholism, father of alcoholic insanity; the social evil with its attendant venereal diseases, especially syphilis, the sire of paresis; and heredity, operating thru the breeding and interbreeding of defective stocks. If, in addition to the recognition of the causes, we appreciate the perils of insanity for the individuals whom it overtakes and for the society which involves us all, we can but welcome a program which offers a reasonable hope that the onward rush of the curse may be stayed.

§ 11. The Economies of Prevention. When we are confronted by an extensive program of action we are likely to pronounce it impossible because it would appear to be extremely costly. But it is sufficient to remember that the effective method is always the cheapest in the end. It is as much our business to protect the future by securing immunity against insanity for it, as it is the business of a man to insure his property against fire and his life against accident, sickness and death to secure the future of his family. Government ought to proceed upon this principle much more than it does.

To observe the economies to be gained by the adoption of a preventive program relative to insanity, let us note what insanity costs when it is let go. The estimates of the number of insane in the United States at the present time is 250,000, of which over 200,-

000 are in state and private hospitals which report to the census bureau. Every patient annually costs society at least $175.00 for care and sustenance. This does not include the investment in grounds, buildings and equipment. All the insane would create a direct expense of $43,750,000.00. Every insane person is withdrawn from productive work during his most productive period. Should we rate the annual per capita productivity of these persons, if normal, at $500.00, we find their withdrawal from productive employments entails an annual loss of $175,000,000.00. Thus insanity levies an annual tax on the citizens of the nation of over $218,000,000.00. With this amount saved we could more than build a Panama Canal every two years. In 1910 the total expenditure in the United States for higher education and the public schools was approximately $600,000,000.00 or less than three times as much. This takes no note of the ruined lives, nor of the misery and suffering which insanity occasions, a far greater cost than the money expenditure denotes.

Insanity in North Dakota must be costing the state in the neighborhood of $650,000.00 a year. In 1910 the superintendent's report indicated the per capita cost, not reckoning the investment in hospital plant, at $190.64. With the 925 inmates the cost of sustenance and care would be $176,342.00. As before, figuring the economic loss sustained by the withdrawal of each inmate from productive employment at $500.00, the loss from this source would aggregate $477,500.00, making the total annual amount previously given.

A program of prevention means that a much greater portion of insanity will be either prevented or cured than at present. In the New York hospitals it is estimated that over 50 per cent or admissions are curable or preventable. These cases are distributed as follows: general paresis, 13.3 per cent; alcoholic insanity, 10.2 per cent; dementia praecox, 16 per cent; manic depressive insanity, 11.2 per cent. With our present backward methods of treatment about 20 per cent of the insane are cured and another 20 per cent are sufficiently restored to be returned home to become partially contributive and supporting tho a large portion of this latter class relapses into insanty. With better methods a much larger portion would be wholly or partly restored.[17]

II. What the Problem Involves

Since the public needs information which pertains not only to the extent, rate of growth, and causes of insanity, but also to the best

17. Proceedings of the Mental Hygiene Conference, New York, 1912, p. 19; Publication No. 1, National Committee on Mental Hygiene, p. 9; and Publication No. 4, p. 4.

means of counteracting and preventing it, a consistent and constructive study of that backward condition in North Dakota should attempt to prescribe a line of preventive action. In indicating what a constructive state program would involve, comprehensiveness of treatment must be avoided even at the expense of important details.

§. 12. Institutions for Treating the Insane. The State has several courses open to it. Let us notice each possibility briefly.

a. *Expansion of the Present Hospital.* This will mean successive enlargements to meet future needs until the institution becomes one of several thousand patients. Large institutions involve economies of administration. Further economy probably ceases after the 2,000 limit of patients is past. By adopting this course the state would postpone for some time the erection of an additional institution. The efficiency of an institution in curing insanity depends on several factors. Those pertinent in this connection are an efficient hospital for the acute cases, scientific medical staff, competent nurses, and thoro classification and separation of the various classes of the insane. The tendency in large institutions is for the incurables to swamp the work of ministering to and restoring the acute cases. Could the above factors necessary for efficiency be secured continuously, a reasonably large hospital should be efficient and at the same time more economical in administration than two small hospitals. But it is safe to say the tendency is to favor the latter.[18]

Much of the expense of maintaining institutions for the insane results from the first cost of the buildings. Those with large buildings, the common plan, have a cost for construction of $1,200. to $1,500. per inmate. Hospitals which construct lesser buildings, the "cottage" plan of construction, cut the initial investment in two.[19]

The annual expense of maintaining the insane varies greatly as is obvious from the following data of cost per inmate: North Dakota, (1912) $190.64; Minnesota, (1912) from $98.99 at Anoka Asylum to $202.05 at the St. Peter Hospital; Wisconsin, about $255.00; South Dakota, (1910) $185.71; Washington (all institutions for backward classes) $169.39; Illinois, $175.00.

b. *Establishing Another Hospital with Identical Functions.* Dismissing the item of economy, to establish a second hospital having similar functions with the present one, might conduce to efficiency. This, however, would depend on securing the presence of factors of

18. Proceedings of the National Conference of Charities and Corrections, 1907, pp. 384-397; Report of Committee on Adequate System of Care for the Insane.

19. Henderson's Dependents, Defectives, and Delinquents, p. 193.

efficiency mentioned above. To allow incurables to congest and swamp the work of restoring the curable would render two hospitals as inefficient as one. But if the safeguarding factors of efficiency were provided, the smaller hospitals should secure greater effectiveness because the superintendent and his staff would be able to come into closer touch with the various parts of the Institution. Without these safeguards, duplication would be unjustified. Were two hospitals or more well distributed in the state, efficiency in restoring patients would be secured thru preserving the interest and cooperation of relatives and friends. This much needed factor is often sacrificed where the great distance of relatives from the hospital places a premium on neglect.

c. *Establishing a Second Hospital Having Distinct Functions.* In some of the states separate hospitals are maintained exclusively for the curable insane, while the chronic cases are assigned to asylums for custodial care. This is an advantage to the curable cases, because they may be kept unaffected by the disturbing conduct of turbulent chronic inmates. It might prove to be disadvantageous to the latter class, since restorational agencies would likely be abandoned. Occasionally after the lapse of many years a supposed incurable patient recovers sanity. Could opportunity of recovery be duly safeguarded in the present hospital, which doubtless would be devoted to chronic cases, a new institution for incipient and acute cases would justify itself, providing no better plan is feasible.

d. *Establishing District or County Psychopathic Hospitals for Incipient Cases, Retaining the Present Institution for Chronic Cases.* The necessity for earlier recognition and treatment of mental troubles will be discust under section 14. This is of fundamental importance and should have great weight in deciding what course shall be followed. Local institutions or provisions in general hospitals for psychopathic treatment would have the double advantage of securing treatment as soon as the malady manifests itself and of securing the continued interest and help of relatives and friends for the patients. The early entrance of patients would be furthered by legalizing voluntary commitment, a most necessary provision which will be discust later. (See Sec. 15, point b.) It would be feasible to locate such hospitals in the more populous counties and centers, grouping the adjacent counties abou tsuch a center into a district. This would be preferable to the individual county plan, since enough physicians trained in psychiatry could not be obtained to operate county hospitals.

It must be noted that psychopathic hospitals and psychopathic

wards in general hospitals would increase the cost of caring for the insane. For such treatment, Dr. Frank P. Newbury estimates the cost at $18.00 per week, while he estimates the cost of the asylum method of treatment at $175.00 per year.[20] Even if this is an overestimate, it is certain that the cost would be greatly enhanced. Even so, if the result should be a prevention or a considerable reduction, the state would save money by making such provisions. Efficient, rather than make-shift, methods always pay. But of this there can be no question, that the leading medical men of the nation who have interested themselves in insanity have gone on record in favor of psychopathic method of treatment, and the National Committee for Mental Hygiene strongly advocates it.

e. *Establishing County or District Hospitals for the Care of Harmless but Able-bodied Chronic Insane, Retaining the Present Hospital for the Treatment of Acute Cases.* Besides supporting two state institutions for the insane, Wisconsin sustains 35 county hospitals, one of which, the Milwaukee Hospital, is semi-state. The county system keeps the insane in touch with their friends and relatives and provides facilities for giving them contact with nature. Further, the superintendent is brought into closer touch with the inmates. Competent authorities believe the Wisconsin system provides as wise and generous care for the insane as can be found.[21] North Dakota is not ready to establish a hospital in every county but it might establish such institutions in the more populous counties as district institutions, and place them at the disposal of adjacent counties. Some of our counties now have 40 to 60 patients in the state institution, and such counties could well undertake the support of a county hospital.

f. *Retention of Present Hospital for Acute Cases and for the Violent and Invalid Chronic Insane, the Establishment of Farm Colonies for the Harmless and Valid Chronic Patients, Supplemented by Provisions for Family Care of the Latter Class.* Thus the state institution would maintain a detention hospital for the restoration of curable cases and would have an asylum for the custody and care of chronic, violent and invalid patients. But a large body of chronic insane are physically able and harmless. They are able to perform much work and enjoy contact with nature. Institutions combining the idea of "cottages" or residential places and large area of land which may be tilled would be serviceable. The cottages would in-

20. Journal of the American Medical Association, 1914, p. 1904.
21. Smith's Social Pathology, p. 217.

volve a smaller per capita outlay for construction than the great buildings of older institutions. The land would utilize their labor and make them largely self-supporting. All could find satisfaction in coming into close touch with land, air and sunshine. This plan could very well be combined with the county or district plan.

A somewhat distinct idea is involved in legalizing family care of insane. This is advocated by the highest authorities and has been resorted to in European countries with most satisfactory results. It is also employed somewhat extensively in Massachusetts. Family care relieves the patient of much of the monotony of institutional life, is regarded as slightly less costly than asylum care in maintenance and obviates the outlay in the construction of buildings.

§ 13. Adequate Equipment. Whatever choice the state makes it should regard the equipment of its hospitals, so that the full restorative influence is operative, as fundamental. This involves ample room for the proper separation of certain classes of inmates, provision for applying the most effective cures such as hydrotherapy, and re-education thru industrial occupations, an adequate staff of physicians trained in psychiatry, a corps of professional nurses and attendants, and provisions for amusements and recreation which not only minister to enjoyment but are effective agencies of restoration.[22]

Our present hospital is backward or lacking in every one of these items. It has had one room and bath where hydrotherapy may be adminstered, when it should have had dozens or scores. The new building will furnish some relief. There is little or no provision for industrial education, save the farm for men and the laundry and scrubbing for women. The staff of physicians is inadequately small. The superintendent, with the heavy duties of administering over a population of 1,100 persons, has to act as medical officer to over 300 inmates. There has been an inhuman crowding and congestion of patients, breaking down the morals of the population and rendering curative treatment almost impossible; the staff of attendants is composed of pickups and transients with no special interest and insight in their work and whose average tenure is about one third of a year; there is little or no provision for stimulating psychical activities by way of play, amusements, and various forms of recreation.

§ 14. Special Psychopathic Provisions. The great progress which has taken place in the treatment of mental disorders has been due to the recognition that insanity is a disease of body and

22. Proceedings of the Mental Hygiene Conference, New York, 1912, pp. 14-19.

mind and that the insane person must be treated as a sick person rather than an abnormally dangerous one. The deeper study of the insanities has resulted in the discovery that there are many well defined types of mental disorders, some of which are curable. Further, certain well defined indications of the curable types have been learned, such indications revealing themselves in physiological and psychological laboratories especially equipt for purposes of examination. Hence has arisen what is known as a psychopathic hospital where the incipiently insane or mentally troubled person may repair for observation, investigation and treatment.

The prevalent system of treating persons with mental disorders is to await the complete manifestation of the trouble, the application of legal methods of examination for deciding on insanity, and the commitment to a distant state hospital. This system violates scientific and humane principles in several respects. First, adequate investigation and treatment are delayed too long. Promptness in recognizing the type of trouble and in treating it is a necessary precaution to prevent the case becoming chronic. Second, the legal process of deciding the case and commitment to the state hospital attaches a stigma to the afflicted person by branding him as insane. This is both unnecessary and unjust and amounts to prejudging the case. No one should be pronounced insane until the case has been proven to be incurable. The fight the recovered person is forced to make against the social stigma of having been insane is one of the greatest hindrances to remaining sane. Third, commitment to a state hospital often means association with violent and noisy persons, which is a seriously disturbing factor and conduces to deepening the disorder. The state and society must rectify its procedure and establish a system under which a mentally sick person may be treated in the initial stages of the disorder as a sick and not as an insane person.

Many states have provided psychopathic facilities and various plans have been followed. In Minnesota, detention hospitals connected with three of the state hospitals for the insane, have been established. These are open to persons who may voluntarily commit themselves or who may be sent by their friends for treatment. It is found that a large number of persons have voluntarily applied for treatment. No stigma attaches to them upon recovery.[23] This plan is followed in several other states.

In some states separate psychopathic hospitals have been built. This is notably the plan in Michigan where such a hospital has been

[23]. National Conference of Charities and Corrections, 1912, pp. 519-528.

built in connection with the state university and cooperates with the state hospitals for the insane. It has the advantage of having the expert assistance of the state medical faculty and of the university psychologists, and of affording a training clinic for the students who are in training as doctors.[24] Another plan is to provide psychopathic wards or pavilions in general hospitals. This is done in Albany, N. Y., and in new general hospitals in Indiana and in Clevelond, Ohio.[25]

What a state at the beginning of its system of caring for the insanse should provide is facilities which are reasonably accessible. Provisions remotely accessible cause delay and frustrate beneficial results. It would be wise to consider the feasibility of creating district psychopathic hospitals, or wards in well distributed general hospitals.

§ 15. Preventive Legislation. There are certain laws which it would be well to enact in North Dakota. They would be of a preventive and ameliorative nature relative to insanity.

a. *Law against Placing Mentally Disordered Persons in Jails and Homes for the Poor, and for Giving Health Officers Jurisdiction over such Persons.* In many of the states mentally sick persons are committed to jails and poor houses, in some cases being so confined permanently. Both jails and poor asylums in this state contain insane persons. In the Cavalier County jail a violent and dangerous person was kept two weeks along with other prisoners, the latter being obliged to care for him until they rebelled.[26] Neither institution is a fit place, either as a detention or custodial place, for mentally disordered persons. Relative to jails the idea and process of being locked in jail produces a decided mental shock, besides a police officer is incapable of dealing with deranged persons in a sympathetic and soothing manner. Only a competent health officer who is a medical man has the insight and experience which will provide proper treatment. Incarceration in jail, often with other prisoners, must necessarily be disturbing and detrimental to a person troubled in mind. A poor asylum is an unfit place for detention or custody since the person is sick and demands treatment such a place is unable to afford. With jurisdiction over cases of derangement a health officer can provide a detention place in home or boarding house with a nurse as attendant until a final disposition is made.[27]

24. Ibid, 1909, p. 462.
25. Ibid, 1909, p. 462; 1912, p. 528.
26. Gillette. The Quarterly Journal of the University of North Dakota, January, 1913, pp. 112-113 and 124.
27. Conference of Charities and Corrections, 1910, pp. 265-267; Publication No. 4, National Committee on Mental Hygiene, p. 19.

While North Dakota statutes do not put a premium on placing insane persons in jails and poor houses, they do specifically indicate under what conditions this may be done. In case the state hospital cannot receive applicants, the "commissioners of insanity" may commit them to either institution.[28] Appropriate legislation should be passed making this illegal and providing competent guardianship during such contingency.

b. *Improvement in Methods of Admission and Commitment.* The term "admission and commitment" denotes the processes involved in taking public and legal recognition of insanity, deciding the truth of the accusation, and if sustained making disposition of the insane person, generally a commitment to the state hospital. In this state a board called "commissioners of insanity" exists in each county for this purpose. The board consists of the county judge who is chairman, and of two other members, one a medical man and the other a lawyer. The case is decided by this board, the person charged with insanity retaining the right of legal defense. In its medical representative the law is scientific and humane. But as has been denoted previously our process is inhumane and inadequate in making poor houses and especially jails places of detention and custody. Our law is also inadequate in that it makes no provision for voluntary commitment. Our laws should recognize the right of persons who show symptoms of mental disturbance to seek immediate treatment in an institution which is specialized for that work. Such an institution is found only in the state hospital for the insane. The average person cannot afford to go to private hospitals. The state is the only means of relief.

As already noted, voluntary commitment is being provided for in various states. California, Connecticut, Colorado, Illinois, Maryland, Massachusetts, Michigan, Minnesota, New Jersey, New York, Ohio, Pennsylvania, and Wisconsin, and perhaps other states now have it. The principle involved is fundamental for prevention. The earlier a mental disorder can be detected, providing it is not of the chronic type, the greater the probability of a cure.

The fact that so many states have established voluntary commitment is an argument in favor of its establishment here. An additional argument is found in the extent of its employment where it has had time to demonstrate its value. We have the record of

28. Laws of 1896. Koren Summaries of Laws in Commitment and Cure of Insane, New York, 1912, p. 205.

voluntary commitment in Massachusetts during eight years. The accompanying table (Table IV) shows it growth:[29]

Year	Number of Voluntary Commitments	Per cent of Total Inmates Voluntarily Committed
1906	125	5
1907	156	5
1908	195	6
1909	185	6
1910	200	6
1911	237	7
1912	282	8
1913	636	16

Both the actual number of persons using this method and the proportion of all insane who employ it have increased several fold. This indicates that mentally troubled persons have come to have faith in the efficacy of early treatment.

c. *State System of After-care.* We have become accustomed to systems of after-care in the case of inmates paroled from the state penitentiaries and reformatories. The system is being advocated for patients sent home from sanitoria. A number of states have put the parole or after-care system for the insane into effect. European states have practised it successfully for over 85 years.

After-care for the insane is based on the fact that mental disorders are joint products of the personal equation and the surroundings. Should the patient recover in a hospital and be sent back into conditions which helped produce his disturbance, mental derangment might be expected to return. In experience this expectation is realized. Consequently a watchful system of guarding the patient from the time he is approaching recovery in the hospital until after he has proven to be free from danger of another mental breakdown is demanded. This is accomplished either by voluntary associations such as the State Charities Aid Association of New York, or by maintenance of parole officers by the state, as is the case in Minnesota. The functions of the after-care system may be denoted as follows: "1. Paving the way for the discharge of patients by seeing that the necessary conditions can be assured in the old or new homes. 2. Securing positions and work for those needing such help. 3. Financial assistance, temporary board during convalescence etc. 4. Visits to insure the carrying out of the recommendations, and occasional timely consultations of the physician." 5. Encouragement of the patient

29. E. E. Southerd: Journal of the American Medical Association, November 28, 1914.

by means of the knowledge that some one, especially the state, has an interest in him.[30]

d. *Laws Protecting Society against the Propagation of Hereditable Insanity and Mental Defects.* Among the modern methods of checking hereditary evils, including insanity, are eugenic marriage laws and sterilization laws. The extent of this movement for regulation appears in the following quotation: "At present thirty of the United States, including territories and the District of Columbia, have restrictive marriage laws of some sort. Twenty-two of these simply declare voidable marriage of insane persons or of idiots. In several of the states there is a general statement to the effect that marriage of those physically incapable or having a want of understanding may be declared voidable. The remaining eight states have definite legislation restricting the marriage of the unfit of various classes."[31] Twelve states have also passed laws making legitimate the sterilization, by such means as vasectomy or even by castration, of mental and moral subnormals in institutions, but these laws are not generally observed.

In 1913 the legislature of North Dakota passed laws providing both for a eugenic restriction of marriage and for the sterilization of certain defectives. The former law provided that applicants for a marriage license must first secure a physician's affidavit, certifying to their physical condition with a view to excluding from marriage drunkards, habitual criminals, epileptics, feeble-minded, insane and those suffering from venereal disease. The latter law makes legitimate the compulsory or voluntary sterilization of confirmed criminals, insane, idiots, defectives, and rapists, in institutions of the state. Provision is made for suitable expert consideration in each case. Up to the present this law has been carried out only in a few cases of recurrent insanity at the insane asylum, where the results have been very satisfactory. It has not been found necessary to make the operation compulsory, as consent is readily obtained when the nature of the operation is understood. Both laws are patterned on laws that have been successfully put in force in other states. As the advisability and present success of these laws can best be passed upon by the medical profession, a questionnaire was recently sent out to between thirty and forty of the physicians in the state, particularly those in the larger cities. Twenty answers have been received, with the following results:

30. Conference of Charities and Corrections, 1908, p. 306; 1910, pp. 283ff., 294, 458ff, and 1912, pp. 343-345; Publication No. 5 National Committee on Mental Hygiene, p. 20.

31. Smith: Marriage, Sterilization, and Commitment Laws; Journal of Criminal Law and Criminology, Vol. V, pp. 364-370, 1914.

With regard to the marriage law, all agree that it is being observed to some extent tho it is frequently evaded by persons going out of the state, and the examination is sometimes superficial. There is, except for two dissenting voices, complete unanimity as to the wisdom of the law, and the advisability of keeping it in force, tho some suggest minor changes. Most are emphatic in their support of the principle involved. The changes recommended include more specific directions for the examination, making it include the Wasserman test for syphilis, and the recording in some form of a personal and family history chart. It is also suggested that the wording of the law should be so changed as not to throw on the physician the responsibility for conditions that cannot be recognized by means at his command, as is the case with epilepsy, for which there is no recognized test. In such a case, apparently, the responsibility should be with the applicant for the license. As to the argument commonly put forth that a restrictive marriage law will result in illegitimate births, only two think this a real danger, four are uncertain, while fourteen consider the danger negligible in view of the advantages of the law.

There is somewhat less unanimity in connection with the sterilization law, tho even here the opinions exprest stand fifteen to five in favor of the law. The necessity for careful safeguarding is, however, suggested, and the possible danger attending the removal of responsibility in the event of the vasectomy of sex "maniacs" is pointed out. In the questionnaire the question was added as to whether sterilization might safely be made use of outside of institutions. Seven said yes, two thought it could be done in the future, three were uncertain, and eight said no.

Summing up, it may be said that the limited experience with marriage and sterilization laws is satisfactory. To those who realize the great part that inherited and incurable defect plays in the production of human misery and delinquency, there is no question as to the immense ultimate importance of such laws. The dealing with the hereditary phases of the problem is increasingly important with the advance of the humanitarian spirit. To-day, thanks to the broad operations of philanthropy, the defectives are increasing at a more rapid rate than are the normal. The cure is certainly not to go back to the barbarous social conditions when a cruel struggle for survival eliminated the defectives, for such a struggle eliminates also much that is finest and best in the human race. The cure rather is to be found in the social control of reproduction so that eventually by marriage restriction, sterilization, and segregation, the defectives

will be largely eliminated. The present great obstacle, of course, to such a program is the uninformed state of public opinion on the subject. Perhaps it would be the wisest policy at the present time in North Dakota to continue in force the present laws, with possibly some minor changes to make them work more smoothly, but not to attempt to push the scope of the laws further until public opinion is educated to demand more, tho the state should at once provide for compulsory segregation of defectives. The laws as they stand at present undoubtedly are having some slight eugenic effect. But what is more important at the present stage, they are having a decidedly educational effect. To extend their operation at once might lead to a reaction that would be fatal to the whole movement.

e. *Laws Requiring Training in Psychiatry of Doctors and Lawyers Who Practise their Professions in North Dakota.* In this state, as we have observed, the legal process of deciding on the sanity or insanity of a person rests with a board which is composd of doctors and lawyers. In many other ways, both sets of professional men become connected with insanity in a manner very vital to the persons mentally sick. The average medical school and law school at present give little or no attention to the subject of insanity, especially to its psychological aspects. Since it is a mental ailment, whatever else it may be, full understanding of its nature and a ready sympathy with its manifestations cannot be obtained under the present system of training. It is particularly important that physicians should be trained in mental diseases. German medical schools for a long time have had their psychiatric classes. Provision for such work is slowly creeping into the schools of this country. The state medical school should be encouraged to make psychiatry a part of the training of our medical men, and the state by appropriate tho not extreme legislation should emphasize its necessity.[32]

f. *Law to Compel Support of Insane by Relatives.* States generally have assumed the support of persons who are sent to the hospitals for the insane. This is just and necessary in perhaps the majority of cases. Yet some of the progressive states are moving in the direction of requiring that, where the relatives of the insane person are financially able, they shall assume such responsibility. In Ohio, such a compulsory support law was passed in 1910. It provides that where financial ability exists, the following persons shall be held responsible: guardians for wards, husband for wife and wife for husband, parents for children and children for parents; also that if the estate of the inmate is sufficient without hardship to dependents

32. L. F. Barker, M.D., Publication No 4, National Committee on Mental Hygiene, p. 4.

and no guardian exists, such guardian shall be provided.[33] Kansas likewise provides that financially able patients and relatives shall be held responsible for support. Its statute was tested before the Supreme Court of that state and was upheld. As a result, over $100,000. has been collected by the state for support.[34] A carefully formulated law applicable to conditions in North Dakota would doubtless lessen the burden of supporting the insane which county taxation now sustains and would visit injustice and hardship on no one.

g. *Special Provision for Criminal Insane.* The conviction is forming among those who study insanity and have had experience in its treatment that the criminal insane should be separated from all other insane for treatment and custody. The nature of their disease is such that they are either a menace to the lives of other patients or by means of their mischievousness and destructiveness make the cure of the non-criminal very difficult. Pennsylvania has solved the problem by establishing a separate institution for this class. Kansas has established a hospital for the criminal insane in connection with its state penitentiary. Virginia has bet the situation by erecting special buildings for them at its Central and Southwestern Hospitals.[35]

§ 16. State Commission for the Study of Mental Deficiencies. The State of North Dakota confronts a situation which makes a demand on its greatest wisdom and ability. The situation is one which no enlightened state legislature and administration can disregard. While the insane and feeble-minded are results of conditions, they are at the same time the cause of many evils. The gravest effects consist in breaking down the physical and mental integrity of our social stock. Civilization and all that goes with it must ultimately be swept away unless our leaders can discover effective methods of preventing mental deficiencies. When it is remembered that at least 50 per cent of insanity is hereditary and that even a greater per cent of feeble-mindedness is such, and that they spread their blighting effects by intermarriage all thru the population, the extent of the menace is obvious. This is not rhetoric but basic truth. That it is not colored every thoughtful student of the facts recognizes.

The economic effects have been dealt with in a previous connection. It is sufficient for our purposes here to remark that insanity and feeble-mindedness promote poverty and pauperism by mak-

33. Koren: loc. cit. p. 216; Conference of Charities and Corrections, 1911, p. 453.
34. Koren: loc. cit. p. 91; Conference of Charities and Corrections, 1910, p 578.
35. Ibid, 1911, p. 453; 1912, p. 528.

ing those afflicted incompetent to carry on self-supporting occupations. Not only themselves but their dependents suffer the economic losses. The state is taxed for their support, care, and cure. Their industrial productiveness is substracted from social productivity and the state sustains a great loss in this way.

The effects on families, relatives, and friends, in distraction, anxiety, and sorrow are beyond the power of any words and phrases to express. Only those who have had imbecile children or have seen their near and dear go down into the darkness of mental disorder can realize the dreadfulness of such afflictions. To most of us it is given only to look on and to sympathize.

It is important to realize that the states "with highly developed systems for the care and treatment of the insane also have the best and most complete laws on the subject. On the other hand, where standards of care are comparatively low and the provision for the mentally ill inadequate, one is certain to find the laws rudimentary and insufficient. The insanity laws as they stand today impress one, beyond the fact that so many of them are wholly inadequate, as the product of hasty, unsystematic tinkering. Very few constitute a well-rounded whole or bear marks of farsighted study." Most of them are ancient structures which have been amended from time to time. Their constant amendment amply testifies to the organic insufficiency.[36] These are the words of the best authority in the United States on the legal provisions for inasnity.

North Dakota faces the great problem of making scientific provision for the treatment of the mentally deficient classes. It has never made a thorogoing study of these classes and their promoting conditions. Its statutes pertaining to insanity, as a consequence, have not arisen in response to an understanding of its problem in all its fullness. It will never deal with the situation intelligently and completely until it investigates the situation thoroly and makes its legal provision to meet the demands. The approach must be made by the establishment of a scientific commission whose duty it shall be to study the conditions in this state, to seek the best methods of care of the insane and feeble-minded and to formulate a suitable state policy.

§ 17. State Public Welfare Association. It is common thruout the states to maintain a state charity association which interests itself in the principles and work of prevention and care of the backward classes in the state at large. It is a voluntary association and exists as an educative body chiefly. Its business

36. Koren: loc. cit. pp. VII-VIII.

is to educate the public mind pertaining to matters of philanthropy and to seek to secure community cooperation to carry into effect the best means of dealing with pauperism, crime, insanity, feeble-mindedness, and kindred ills. Sometimes such an association has a quasi-public character, bearing certain public functions committed to it. But its great work is to get light on the actual conditions in the state, to develop ideals and principles for remedying them, and to educate the public into a realizing sense of their significance.

North Dakota very much needs the services of a voluntary organization which shall take up and promote this work. Aside from the state supported institutions, we have little or no organized surveillance of conditions. We have the beginnings of organized charity work in various cities, problems of social welfare of various kinds have arisen both in city and country, but there is no place where all interests may meet and discover their relation to each other. The state needs educating and quickening in matters of insanity, feeble-mindedness, epilepsy, crime, pauperism, prostitution, public amusement, and recreation. With its three quarters of a million of people, North Dakota has come to the stature of adult statehood and must equip itself with modern agencies for the exercise of its heavy responsibiity.

There are objections to the name of charity in connection with a state voluntary association which seeks to study and correlate all the different public welfare interests. It is too narrow a term to cover all of the activities involved, charity being only one of several aims which such an organization should promote. Further, there is a certain stigma which is attached to the word. Deserving people do not like to be classed as objects of charity. Consequently it would be better to adopt a name which does not bear an undesirable significance and which has the appeal of inclusiveness and constructiveness. Such a phrase as social or public welfare would meet the requirements. A North Dakota Public Welfare Society would represent all the interests and needs which are demanding thoughtful consideration. It probably would hold an annual convention in which the common interests of all the kinds of welfare work would be discust in a general session and the special interests would be considered in appropriate special sections. Its membership would consist of all citizens of the state who desire to enlist their interest and support and its annual session would be made of representatives and delegates from the various state and local interests and organizations. It would be a medium of investigation, discussion, discovery of methods, and principles of progress in welfare work, and a means of disseminating enlightenment regarding such work thruout the state at large.

Book Reviews

THE STATE. ITS HISTORY AND DEVELOPMENT VIEWED SOCIOLOGICALLY: FRANZ OPPENHEIMER, Authorized Translation by John M. Gitternian: Bobbs-Merrill Co., Indianapolis, 1914.

This book appeared in Germany in 1908 and was pronounced by Dr. Adolph Wagner, the famous German economist, as the most important work of its kind ever produced. The reader must draw his own conclusions, but without doubt it is highly suggestive for those who know their history and sociology.

The contribution of the book is in the emphasis on the political control of the state, as a development from economic conditions, for the purpose of protecting class interests. The author states frankly that future progress will be in the direction pointed out by Socialism leading ultimately to a free society unhampered by monoply. The existent class monopolies are not economic, but political. That is, the existent state is used as a means of protecting those who own and control the various monopolies of land, transportation, and production.

For centuries the state has been a class state. It had its origin in conquest and subjugation. Little by little as the economic rights have been enlarged the state moves from the crude organization of a primitive people to the concept of Freeman Citizenship. "The nomad is the inventor of slavery, and thereby has created the seedling of the state, the first economic exploitation of man by man." (p. 37.) In his presentation of the development of the state the author speaks of the primitive feudal state, the maritime state, the feudal state, and the constitutional state. These have passed thru the six stages which must be mentioned if the reader of the review is to catch the import of the book.

The first stage consists of those land states developed by the subjugation of peasants who remain on the soil and pay tribute. The second stage shows an amelioration of the conditions and the taking of the surplus only by the conqueror. In the third stage the payments made by the conquered are reduced to regular and stated intervals. Thus follows the union of both groups, the conqueror and the conquered. The fifth stage is the period of a central authority and finally the development of the habit of obedience. In the movement thru these stages there is a combat between the economic, which works towards a wider freedom, and the political organization of the state. The outcome is a freedman's citizenship and the disappearance of economic exploitation.

Such in brief is the book. The author's contribution is one of method and content. He has regarded the state as a product from the facts of history and sociology and as such it must be viewed sociologically rather than deductively. In this respect the book differs markedly from its predecessors in the same field.

F. L. McVey

University of North Dakota

The Renaissance, the Protestant Reformation, and the Catholic Reformation in Continental Europe: Edward Maslin Hulme, Professor of History in the University of Idaho. The Century Company, New York, 1914. 589 pp. Price, $2.50.

There has long been needed in brief compass a comprehensive survey of the allied fields of the Renaissance and the Reformation. The author is to be congratulated on having successfully accomplished this difficult task and having produced not merely a readable book but a useful text as well. The three portions of the work are each treated separately with distinct emphasis upon certain salient features. But what is of equal importance, the subject matter as a whole is made to appear as a single presentation in which the parts mutually reenforce and explain each other. This intimate relation existing between these two great periods of history has often been sketched. Professor Hulme has been singularly successful in fusing the separate units of his discussion so as to unite them in a mingled stream as his argument unfolds from chapter to chapter.

The Reformation is perhaps better treated than the earlier period. Here we are shown the national elements of the struggle in France, Spain, Germany, and the Netherlands. For some reason England does not seem to receive the share of the discussion to which her prominence entitles her. The chapters on the development of letters and art make it clear that in spite of the religious controversy, the Renaissance movement is still proceeding, tho more below the surface than at our earlier time. The chapter on humanism and heresy is especially suggestive in this connection and the important contribution of Erasmus is fully presented.

In the chapters on the Renaissance there is more of convention and less of freedom in the handling of the subject. One would like to have heard more of the national work of Wyclif, Langland, and Chaucer than is given in the brief notices they receive. The birth of national consciousness in England in her great transition period

of the fourteenth century gives to the work of these writers a special significance. Nowhere in the entire Renaissance period does any writer present so vivid a picture of the true national group in actual process of amalgamation as we have in Chaucer's Canterbury Pilgrims. Machiavelli in his Prince gave the world an abstract and coldly scientific analysis of the nature of a sovereign state. Chaucer, with true poetic vision, drew a matchless picture of what was taking place within the innermost circle of English life, where patriotism and free thought and good fellowship were just beginning to put forth their buds and shoots and to make abundant promise of what the new nation was destined to be.

The chapters on the Renaissance lack, somewhat, in giving the economic background, without which it is difficult to understand much of what was transpiring in Europe. The appearance of free capital at the trading centers and its effect in breaking down the old fashioned feudalism based on barter and agriculture needs to have more adequate treatment than is given in the present work. Every student is anxious to learn more of the relatively sudden transfer of investment from unproductive to productive forms and the rise of that most important group of financial operations, credit, interest, state loans, and exchange. He is constantly inquiring as to the causes that produced the great loss of prestige to the church soon after the Crusades and the significant shift of interest from saving ones own soul to the earning of the utmost possible from all available labor or capital. These aspects of the Renaissance are of fundamental importance and connect this period vitally with those that follow. Possibly in a later edition of this timely work the author may add a few more chapters so as to round out these more obvious deficiencies and render the presentation yet more useful both as a text and as a work of reference.

O. G. Libby

Department of History,
University of North Dakota

The Anti-Alcohol Movement in Europe: Ernest Gordon. Fleming H. Revell Company, New York, Chicago, and Toronto, 1913. 333 pp. Price, $1.50 *net*.

To one who desires to understand conditions in Europe relative to alcoholism, both as to evils and the campaign for complete abstinence, the volume is indispensible. It is comprehensive in scope and condenses a large volume of facts. Each of the nine chapters is fol-

lowed by a bibliography and notes. The volume contains a thirty-five page appendix which consists of statements relative to statements of scientific bodies, the Maine appeal of 1911, and quotations of speeches and addresses against alcoholism, not the least noteworthy of which is that of the German Emperor, 1910.

Chapter I, "Daybreak in Europe," details the beginnings and status of the anti-alcohol movement in Europe. It shows that the movement has pervaded all classes and the schools of most nations; that it has been considered by legislatures, and is promoted by various voluntary organizations, industrial companies, and congresses. Iceland legalized prohibition in 1909. The Faroes prohibit the sale of alcohol. Denmark has not legislated against alcohol but the citizens have organized voluntary votings instructing magistrates to end the sale. The same is done to a less extent in Holland and Germany, and the Finnish Landtag has twice legalized prohibition, Russia having vetoed both acts at the pressure of the French nation, its great creditor.

"Europe Alcohol-sick" is the subject of Chapter 2. Conditions relating to alcoholic consumption and the evils resulting are traced in Germany and France especially, altho other nations receive attention. Professor Muensterberg, of Harvard, is quoted in defense of European drinking customs. His two eminent brothers in Europe are pitted against him. One of them is Europe's most eminent authority on Charities. He shows how the 808 beer dives of Berlin destroy thousands of waitresses, few of whom are reclaimed. Drunkenness and alcoholic insanity increased five-fold, delerium tremens three-fold, heart-sickness five-and-one-half-fold between 1877 and 1901, while the German population increased but one-third. Carnal attacks on children almost doubled between 1890 and 1900. Germany spent 27.74 per cent of its food and drink bill for alcohol. Berlin contains 30,000 dwelling houses and 15,000 licensed drink places besides many that are carried on contrary to law. Idiotic, weak-minded, and physically inferior children emerge from families of drinkers. Germany is dedicated to beer guzzling as France is to wine and brandy drinking. There is a drink-shop in France for every eighty-two persons and three saloon keepers for every baker. In 1881 it had 367,000 saloons and 47,000 insane; in 1907, 477,000 saloons and 70,000 insane. Resrictive laws are rendered farces because of the powerful influence of drink-shops in elections. Saloon keepers hinder anti-alcohol instruction in the schools. They multiply market and fair days so as to extend their trade, causing idleness and drunkenness. Commerce is waning, land in Normandy lying

fallow, industries are languishing for lack of competent workmen, and are importing their best artisans. Trainmen drink a liter (a little more than a quart) of brandy or rum on their runs. Monday is the fatal day for accidents due to Sunday debauches. Alcoholism and tuberculosis, its companion, are depleting rural life. LaManche had 600,000 people in 1852 but only 488,000 in 1901. Women are drinking heavily. In Normandy nine out of ten working-women are alcoholists. The children of such mothers follow their example. A teacher of the Hautes Pyrenees reports children who consume a liter of wine a day. Not only are they rickety, but intellectually and physically degenerate. These facts relative to Germany and France may stand for conditions in Austria, Holland, and Belgium.

Chapter 3 deals with "International Congresses Against Alcoholism" bringing out the more salient facts presented at each Congress. Professor Demme, of Berne, studied for years the effects of personal and parental alcoholism on children. Hydrocephalus, epilepsy, misgrowths, cretinism, convulsions, melancholia, idiocy, and a great variety of other defects were found to follow the drinking of the fathers. (p. 87). Kraeplin and Smith investigated the effects of alcohol on memory and association, finding that its use decidedly impairs those psychical functions (Charts pp. 89-91). Gaule and Overton discovered why alcohol is so injurious physiologically. Alcohol withdraws water from the cells causing them to lose activity. Cells have the power generally of excluding substances which are injurious but they have not this ability relative to alcohol, ether, chloroform, and all substances of the narcotic class. Dr. Overton showed why the judgment is first affected by alcohol, then the coördination, then reflexes. Of cells subjected to similar alcohol treatments "the most complicated functions are first stopped and then, in sequence, the less complicated, down to the simplest." (pp. 93-95.) Alcoholism is demonstrated to increase mortality, especially after the age of 43 (p. 106). Alcohol is proven to be a veritable poison and possesses food properties to a very limited extent. (pp. 113-120.)

Chapter 4, "The Traveling Anti-Alcohol Exhibitions," tells how effectively exhibits are used in Europe to promote abstinence. A number of charts from these exhibits are reproduced: Records of school children who use alcohol (pp. 140-141), cases of hand trembling and knee reflexes of alcoholists (142-43), mortality and alcoholism (144), accidents among drinkers (145), decayed teeth and alcoholism (148). These charts are certainly telling against alcohol and they do most effective campaign work wherever used.

The chapters dealing with the growth of anti-alcohol sentiment

in socialism, Chapter 5, among university students. Chapter 6, and among armies, Chapter 7, are most informing and important chapters. It is interesting to learn that the aristocracy, capitalism, and the church have been arrayed systematically on the side of alcohol for what there is in it, and that the workers begin to see that abstinence means increased effectiveness in their emancipation as a class. A graphic account is given of a German university students' drinking bout and the point is made that university students are regarded at large as inferior and useless incumbrances. It is noteworthy that military leaders in France have become protagonists of abstinence and that a vigorous educational campaign is conducted in the armies in behalf of abstinence. German militarists are also waking up, the Kaiser being among the first to sound the note of alarm against the menace of drink in his Mürwik speech.

Chapter 7 deals with the defence alcohol makes and shows that its votaries resort to every device, no matter how unscrupulous, to head off the abstinence movement. A most unsavory position is given the press of Europe. It is put in the light of a pawn and emissary of the higher interests, refusing to publish anything inimical to them and forwarding whatever is to their advantage—all because of advertising profits. The last chapter, "For the Death Sentence," considers programs of anti-alcohol campaigns and favors vigorous educational mesures, particularly in higher educational institutions and inter-party organizations for political purposes.

The volume should have a full index. There is an abundance of valuable matter which such an index would make available.

JOHN M. GILLETTE

Department of Sociology,
University of North Dakota

PAPERS AND PROCEEDINGS OF THE SEVENTH ANNUAL MEETING OF THE MINNESOTA ACADEMY OF SOCIAL SCIENCES. Edited by JEREMIAH S. YOUNG. Published for the Academy by the Northfield News, 1914. 181+VI pages. Price $2.00.

An Academy for the cultivation of the Social Sciences within the bounds of a single commonwealth is in itself an interesting subject. A glance thru the four page list of members and subscribers indicates the widely representative character of this Minnesota institution. The treasurer's report of a "balance on hand" of over $200 is a promising sign of the vigor of the organization. The threefold object of research, discussion, and publication has evidently

met a ready response from its patrons. The scope of the Academy's interests is said to include "important political, social, economic, and historical questions affecting the life of the state" and its practical aim "the formation of sound and rational doctrines relating to legislation and the social and industrial welfare of the people of Minnesota." The subjects of the several Annual Meetings of the Academy present a practical program sufficiently varied to cover all phases of the Academy's avowed interests: (1) Taxation; (2) The Commonwealth of Minnesota; (3) Municipal Government; (4) The Criminal, A Pure Water Supply, and Workmen's Compensation; (5) State-wide Co-operation; (6) State Regulation of Prices and Wages; and the seventh and latest session dealing with the subject of Economic Cooperation.

The four sessions of this meeting dealt with (1) The General and Legal Phases of Cooperation; (2) What Minnesota Has Done in Cooperation; (3) What Others Have Done; (4) Cooperative Finance. An excellent Index of the papers by title with a sufficiently full topical analysis of each, together with the names of the writers under the proper letter,—greatly enhances the value of this volume.

The key-note of the conference was sounded by president E. F. Waite, a Minneapolis judge, on "The Spirit of Cooperation." It is the spirit of mutual helpfulness, of enlightened self-interest which takes in an ever wider range of social sympathies. "It is not merely business; but fraternity; not profit-sharing alone, but economic democracy." It is the dominant note of world movements to-day. The jurist declares for "a fundamental recognition of persons and not property as the basis of organization." As indicative of the signs of the times, he quotes the criticism of "hardly more than a dozen years ago" that we in America were so intent upon the pursuit of personal gain that we showed "neither desire nor capacity for any form of government other than a nominal democracy ruled by a corrupt plutocracy." In the face of this criticism stands the fact of our rapid movement, during the past decade, toward real democracy in government.

Mr. C. W. Thompson, of the U. S. Rural Organization Service, discust the "Essentials of Cooperation" under the figure of "the game" on the gridiron, "which include a goal where capital receives a fixt but reasonable return and where the surplus goes as reward to human exertion; a group of trained players gradually evolving the necessary power thru study and experience; a captain of the team reflecting democratic control with a proper recognition of service; and rules of the game, insuring a fair game where all may play to

advantage; thru foresight that provides a suitable reserve; initiative that emerges in constant growth and improvement; and managerial ability that chooses the best play for each stage of the game; publicity thru accounts and audits that check the fruitless and encourage the useful; and loyalty that binds together the victims of isolation and, out of this increased power, creates a new world of values."

Judge Wilson, extension lecturer on cooperative marketing, in the State University, discust the legal aspects of the subject. "Co-operation," he says, "is the most generally misused word in the American vocabulary. It is applied to every kind of organization from the Steel Trust to an egg shipping association. For the purpose of the present discussion it is applied to the marketing of farm products. Minnesota is one of some four states that have enacted some specific legislation supplementing the general law with regard to organization of corporations. Cooperative associations are so new that four lines cover all the reference to the subject in the standard legal authorities."

Prof. Weld, of the department of Agricultural Economics in the State University, presented a brief but comprehensive survey of "Cooperation in Minnesota." Minnesota took the lead in industrial cooperation before she came to the front in agricultural co-operation. Cooperation among farmers began as early as 1867 in the field of fire insurance. The movement did not attain significance, however, until 1889-90 when the first successful farmers creameries and grain elevators were established. The movement has assumed several forms of considerable consequence, cooperative production, marketing, buying, insurance, communication. Various enterprises under each of these forms are described and suggestions are offered for the promotion of the movement among farmers.

Several cooperative enterprises are described in detail by other writers. "The Farmers' Corporation," at Dassel, Minn., is an example of community cooperation for various purposes under a single, corporate organization. "Cooperation at Hayfield," describes a series of organizations for community cooperations in the interest of the producer. "But we look forward," says the writer, "to the time when a more direct communication between producer and consumer will be affected, the cost of living reduced, and when the toiler, whether on the farm or in the factory will receive adequate and proper returns for his labor."

The three papers on "what others have done" outside the State, give an account of the history and principles of the movement in foreign countries, by men intimately acquainted with the movement.

The session on "Cooperative Finance" produced three papers on the subject of rural credit, which is just now occupying so much time and attention in legislative bodies. Mr. Geo. Woodruff, a banker of Joliet, Illinois, presented a paper on the general principles of land credit or mortgage banking. Mr. Geo. W. Simon, the western agent of the Jewish Agricultural and Industrial Aid Society, gave a very interesting account of his experience with the provision of personal, or "short term," credit facilities to the Jewish Farm colonies under the Hirsch Fund, in the United States. Mr. G. P. Warber dealt with "Agricultural Credit in Minnesota." He emphasizes the need of information as to the existing conditions in the United States, and calls favorable attention to Dr. Jacobstein's investigation of the subject in North Dakota. The State University of Minnesota, thru its Division of Research in Agricultural Economics, has undertaken a similar investigation, the results of which, up to date, are given tentatively. The conclusion is that "the credit conditions are so variable in different sections of the Northwest that it would be hard to say that any one system or scheme of agricultural credit, such as is proposed by people who have studied the European systems, would be apt to meet all of our needs."

The Academy affords an excellent link of connection between the State University and the people of the commonwealth and its evident usefulness as such suggests the possibility of a similar institution in North Dakota. Professor Young of Minnesota University is to be commended for his service in bringing his department into such vital relations with the people.

Willard C. MacNaul
Department of Economics & Political Science,
University of North Dakota

The Cause and Cure of Crime: C. R. Henderson, Professor of Sociology in the University of Chicago. National Social Science Series, President Frank L. McVey, Editor. A. C. McClurg & Co., Chicago, 1914. VIII+175 pp. Price, 50 cents.

This book, "The Cause and Cure of Crime," is particularly interesting, because the writer, Professor Henderson, of the University of Chicago, is an authority on the subject. In society, thruout the world, there is an awakening responsibility for the criminal. This work is offered with the hope that it may help officers and students solve the problems of crime.

The Introductory is a discussion of the study of the criminal. The author urges a personal study and understanding of the criminal class. He gives the history of a number of cases, and while he has found records inadequate, they have suggested certain tendencies which should be studied: the early age of offenders, habit of crime, feeble influence of prison punishment, and the evil influence of alcohol.

The author has defined crime as the deed of a responsible person, rather than a disease of the body. The causes of crime mentioned as external to the criminal, are unwholesome surroundings and inherited defects; while those within himself are evil habits; as laziness, dishonesty, and lust, developed by his failure to control himself. The author says: "The immediate cause of true crime is an evil personal choice; the act of a morally depraved will. Generally, the criminal is defective in body, intellect, and will; at least in some part."

An entire chapter is devoted to the methods of criminal procedure. Technicalities and delays in legal procedure, and the fining system are condemned, while the probation system is commended. Punishment and its effectiveness is next considered, and Professor Henderson contends that offenders should be dealt with in a reformatory rather than in a revengeful spirit. The thought is urged that imprisonment is indispensable in a system of social protection and reformation, but the whole prison system should be improved. The writer says that "it is our duty to put forth our best endeavors to improve the character of those who must be imprisoned." He adds the thought that this would be impossible unless the personal need of each prisoner were studied and dealt with in such a way that upon his release he will be, morally, a stronger man. Scientific and expert study of the prisoner should be insisted upon. More humane mesures should be adopted in dealing with offenders, from the city lockup to the state penitentiary. Prisoners should be provided with work and sufficient remuneration given to support their families. More attention should be paid to the spiritual side of the prisoner's life. The sympathetic interest of church organizations could render valuable service. All men working with prisoners should be of the highest type. In short, persons who must be imprisoned should be treated as men and women, and not as dangerous human beings.

The prison buildings and material equipment are discust at length. Separate institutions are urged for the different types of criminals. First offenders should never be placed with hardened men. The feeble-minded should be sent to special institutions, and colonies established for treating the alcoholic and degenerate.

The prevention of crime is next discust, and the public school is mentioned as the first agency. Medical and psychological examination of school children followed by treatment; forcing children to attend school regularly; and providing special rooms and schools for those who are not normal, are suggested. Religious education in public schools is also urged. The juvenile court is another important agency. Professor Henderson feels that every juvenile court should have an expert medical examiner together with salaried probation officers. Carrying the thought farther, the author discusses the "Big Brother" idea, and schools of discipline for wayward girls. In the closing chapter he considers the influence of religion in the prevention of crime. The book concludes with the thought: "The ideals and motives which we cultivate in this combat have worth for the future and will enter into the best which the world will ever experience."

In this brief review it is impossible to bring out all the valuable points treated by the author. Many splendid suggestions are offered, which, if carried out by people working with the criminal class, would be most effective.

PEARL CASE BLOUGH

Police Woman,
Grand Forks, North Dakota

IMMIGRATION: HENRY PRATT FAIRCHILD. The MacMillan Company, New York, 1913. XII+456 pp. Price, $1.75.

The subtitle of this volume is "A World Movement and its American Significance." The author is sociologist at Yale University, and he has sought to give his great theme a sociological interpretation. Of the many recent volumes which treat the subject of immigration, the one under consideration is about the only one that avowedly attempts to do it in this way. It is true that some others practically do so without, however, setting it as their task.

Chapter 1, Introduction, discusses immigration as one of the forms of the great population movements which have occurred during the course of social evolution, the other forms being invasion, conquest, and colonization. The characteristics of each form are discust so that immigration is given its proper perspective as a world phenomenon. Like colonization immigration is a peace movement, and these two are thus distinguished from invasion and conquest. Immigration is essentially a modern movement and like colonization it must necessarily be a temporary affair.

The historic background of immigration in the United States is developed in chapters 2 to 6, five periods being distinguished: the colonial, in which immigration occurred along with colonization; 1783-1820, the period of small immigration and large birth-rate; 1820-1860, the period begun by the first census of immigration and characterized by the first great wave of European population; 1860-1882, a period in which immigration was disturbed by the Civil War and terminated by restrictive legislation and the waning of Northwest European immigration; modern period, in which the new immigration assumes predominance and national legislative restrictions become more stringent. The author shows that at various times during our history immigration has been viewed as a menace but that it is only in recent times that its economic and social effects have become clearly enough demarked to elicit anything like proper regulative mesures.

Without seeking to give a digest of the twelve remaining chapters, because it would require a very lengthy treatment merely to enumerate the topics discust, I will mention the author's position on some phases of immigration.

Professor Fairchild believes that the economic causes and effects of immigration are more profound than the political, religious, social, or biological. In the earlier periods the political and religious causes operated even more strongly than the economic to bring men to America. But to-day men come to the United States to better their economic conditions, something like a third of them returning to their native land as soon as they have made their fortunes or have utterly failed, while but a small per cent care enough about political matters to become naturalized. The depressing effect of the great volume of immigration on wages and standards of living of the labor population of this country is the most serious influence, altho other effects are serious enough.

In this volume the subject of the effects of immigration on the American population is discust at length and repeatedly recurred to. The author belongs to that class of writers who hold that immigration has increased our population little or none (altho we have received about 30,000,000 foreigners up to 1912) because our native population has been driven to voluntary restriction and sterility by reason of competition with cheap labor and lowered standards of living. He is not dogmatic, sees both sides, but makes a strong case for his view. While sympathizing with his view and his treatment, there are two points which he does not touch and which must be disposed of. First, the trend of civilization, even where there is practically no immigra-

tion pressure, is decidedly toward a diminished birth-rate. France, Great Britain, Switzerland, and other European nations, New Zealand, and Australia, alike manifest the phenomnenon. The United States could not have sustained its large native birth-rate of the period of 1783-1820 in the face of growing civilization even without immigration. Second, the classes of the United States which are least subject to immigration competition, the wealthy and professional classes, exhibit the greatest sterility and infecundity.

Professor Fairchild fairly shows that immigration increases pauperism but thinks that no definite case can be made against it in regard to crime. He has no ingenious argument to prove that it produces or stmulates industrial crises.

Unrestricted immigration can not be an unalloyed blessing to the United States for the reasons cited; nor to the immigrants themselves because of certain evils; nor to the nations of source because population increase occurs before standards of living rise consequent to reduction of population, and besides remittances undermine rather than foster the independence of recipients; nor to humanity at large because the lowering of American standards to the level of that of other nations removes the leaven of the American influence toward a higher civilization. Only a selected immigration is able to yield beneficial results in all these respects.

The reviewer could not refrain from reflecting that while a selected immigration might be beneficial to America it would be difficult to see how the nations of source could be helped by having drawn off their most desirable population elements and having left the derelicts and least desirable. Only the American leaven working as an exemplar to the world could be conceived to recompense the nations of source for their loss.

The problem of immigration at present is projected because of factors of race, exhausted lands for settlement, concentration of population in cities, declining brth-rate of native Americans, lowered quality of immigrants, competition with labor, and increasing failure of immigrants to assimilate. The author makes out such a strong case for the last item that I am inclined to think this is a far greater reason for national control, in the long run, than the economic effects. As he hints several times, we are confronted with the grave danger of having great masses of segregated foreigners within our borders who speak a foreign language, know nothing of, and care nothing for, the spirit of Americanism, and who, further, maintain their inter-racial hatred of each other. President Wilson recently made an appeal to the nation for impartial expression of opinion rela-

tive to the European War. He must have felt the warring of the discordant hosts of foreigners living in the land, each group sympathizing with its native land. Were we at war with a European nation, would these groups ally themselves with us or against us?

Professor Fairchild stands for further and more rigid restrictions on immigration. Specific concrete evils should be abolished. But above all "some far-reaching, inclusive plan of regulation, based on the broadest and soundest principles, in which all countries concerned will occur," should be worked out. Perhaps we are not enough developed to devise such a plan, but we should radically restrict immigration until we can evolve a suitable one. (pp. 435-436.)

John M. Gillette

Department of Sociology,
University of North Dakota

University Notes

The Enrollment

The number of students in residence at a university is always a matter of interest, especially to those who go behind the figures to find out what is being done in the different groups and what is the character of the work that students are carrying on. The University reaches its highest total enrollment during the first semester of the present year. On December first the number aggregated 750, an advance of 11% over last year's enrollment at this time. In the College of Liberal Arts there were 262, in the School of Education, 157, in the Engineering Colleges, 81, the School of Medicine, 60, the School of Law, 89, the Graduate Department, 8, and the Model High School, 93. The freshman class is the largest that the University has ever enrolled, numbering 246. The total number in the colleges is 657 which shows an increase of 12% over last year and of 72% over the figures of five years ago. When it is taken into consideration that there are only about 1100 seniors in the high schools of the state, it appears that the University has had a rather remarkable development in that period.

The Association of Alumni Secretaries

The Third Annual meeting of the Association of Alumni Secretaries took place in New York City and in New Haven from November 19th to the 21st. The Association, which includes representatives from colleges and universities in all parts of the United States, took up the discussion of alumni-university problems which was begun two years ago at Columbus, Ohio ,and continued last year at Chicago. Nearly seventy alumni secretaries, including men from most of the large colleges, were present for the program. The University of North Dakota was represented by William H. Greenleaf, Field Organizer of the Extension Division, and Alumni Secretary.

The organization of alumni secretaries, tho somewhat new, is finding an opportunity for service and a real need for its continuance. College alumni are a vital factor in the development of the college and more and more their importance is recognized. More and more do alumni recognize the responsibility which is connected with this importance. The association, aiming to present in compact form the views and experiences of many men engaged in alumni work, is serving the colleges of the country in a very positive way. In some universities, alumni work has progressed to a high point: in others the work is just beginning: in all there is a need for more

light and a demand for improving methods. No university can fail to profit by the experience of others. The association aims every year to study and discuss methods of organization, methods of financing alumni work, and methods of unifying and making more practical the support that alumni are willing to give their Alma Mater. And in every meeting of the secretaries the enthusiasm and idealism that have always marked American college education is the prevailing note. At the recent meeting in New York and New Haven the inspiration that came to the secretaries from personal contact and friendly discussion was perhaps even more valuable than the many practical suggestions that were carried away.

Among the pleasant features of the Association meeting were the luncheons tendered the secretaries by Columbia and Yale Universities and the banquet given by the Columbia Club of New York City. The Yale-Harvard football game in New Haven offered the final entertainment.

The Extension Division The present year is witnessing a further development of the many useful activities of the University Extension Division under the energetic management of Dr. F. C. English. As to the significance of extension work in general it may be said that the activities here are a part of a broad movement that is rapidly developing among the State Universities of the country. In all twenty-eight universities in eighteen states are engaged, which, considering the fact that the movement now is only in its ninth year, is a remarkable growth. The plan usually followed is to provide correspondence instruction, lectures, and entertainments, to promote public discussion, and to furnish direct class instruction in localities where this is feasible. The movement is, in fact, an endeavor to serve in an educational way all the people of the state.

The work as developed here at present includes the supervision of a rapidly increasing class of correspondence students, already numbering over a hundred, and the directing of lecture and entertainment courses. Many miscellaneous services have also been rendered, from the assisting of belated students and the supplying of information, to the furthering of the interests of high school debating by enrolling new members in the State High School Debating League. The volume of the work may be indicated by the fact that two thousand letters a month are being sent out in answer to various requests, while many further demands are met by personal visits and addresses. Recently as many as ten thousand circulars have been

distributed explaining in particular the lecture work and correspondence courses. The gratifying response to these circulars in the way of a marked increase in the inquiries and requests from all parts of the state constitute ample proof of the active demand for extension service in North Dakota.

It is, of course in acting as a clearing house for educational needs that the Extension Division performs its most conspicuous service. Thru its mediation scores of inquiries receive the attention and answers of specialists. In addition to arranging lecture dates for members of the faculty, it has secured from outside the state high class musical and literary entertainments, as well as popular and instructive lectures. In so doing it has brought cultural advantages of decided educational value to many cities, towns, and rural districts which otherwise would be without such uplifting influences. It is estimated that the extension activities of the University will this year reach at least 75,000 people.

The Supreme Court Decision In the last three months a number of interesting things have taken place in North Dakota. These have affected materially the financial and educational conditions of the State. For some time the State has been increasing its expenditures without any adequate increase of its income. The result is that it now faces the question of meeting its obligations with a decreased income. This has been occasioned, in part, by an injunction against the Oil Inspection Department of the State and an accompanying refusal of the oil companies to pay the various fees for the innspection of oils, amounting to about $200,000 annually.

Notwithstanding this fact, at the meeting of the State Board of Equalization, in August, it was shown that the State had a considerable surplus on hand. Nevertheless, the Board felt it incumbent upon it to reduce the mill-tax levy some 32%. The educational institutions, realizing the difficulty of carrying on their work with the reduction in income amounting to many thousands of dollars, and also being under the impression that there was sufficient income in the state treasury to meet these demands, began action in the Supreme Court to determine the right of the State Board of Equalization to modify the acts of the State legislature. This suit was heard in the latter part of October and a unanimous decision promptly rendered by the Supreme Court sustaining all the points made by the counsel for the educational institutions.

The case was reopened on November 9 and new evidence introduced to show that, instead of having a comfortable surplus as was

stated in August, the State was facing a deficit which, upon the present basis of income and expenditure, will amount to some $312,000 by December 31, 1915.

In view of this situation the Supreme Court permitted the State Board of Equalization to reduce the mill-tax levy from 1.125 as provided by the Legislature, to .765 and to make a pro rata distribution of this smaller amount. The effect upon the income of the University has been to cut the income from the mill-tax about $40,000, and also to raise the question as to the probable payment of the additional $26,000 appropriated by the last Legislature for maintenance purposes.

While this matter concerns especially the educational institutions for the coming year, it is really a much larger question than that, and has brought to the surface a problem that appears in every state having a constitutional limitation upon tax levies. Such a provision is a constant source of irritation to a state trying to find the necessary income for legislative purposes. On the other hand, the increased demands upon the State for progressive legislation and for better conditions generally necessitates more income. While the situation is most unfortunate and while the reductions made will necessarily curtail the work of the institutions of higher learning in the state, it may, in the end, be productive of positive good thru placing the whole question and all the facts sharply before the people.

The University and the Public Health Ass'n. The forty-second annual meeting of the American Public Health Association was held from November thirtieth to December fifth at Jacksonville, Florida. Delegates were present from most of the states of the Union, from the Dominion of Canada, and from the Republics of Cuba and Mexico. In conjunction with this meeting were held a Southern Health Exhibition and sessions of the National Mouth Hygiene Association. True Southern hospitality was much in evidence, the social features of the meeting including an afternoon trip on the St. John's River, an Assembly ball, a musical tea for the ladies, and side trips to such interesting points as St. Augustine, the oldest town in the United States, and the famous Ostrich Farm.

The program presented was of great practical and scientific interest. The address of the retiring President of the Association, Dr. Wm. C. Woodward, Health Officer of Washington, D. C., was most timely. It dealt chiefly with the necessity for bringing together all of the smaller, independent health organizations under one head —The American Public Health Association. A symposium on the

Negro Health Problem was of special interest to those of the North who little appreciated the importance of such a subject. Imagine, if you can, more than fifty per cent of the population of our Northern cities being made up of Negroes! Such is the state of affairs in cities like Savannah, Georgia, and Jacksonville, Florida. A valuable paper on the American Drug Evil, by Miss Jeannette Marks, author of "The Leviathan," led to the appointment of a special committee for a study of the causes and the best means for the control of this terrible destroyer of health and happiness. Among other distinguished speakers at the General Sessions were Dr. Harvey Wiley, of Pure Food fame, Dr. Woods Hutchinson, the versatile writer on Public Health subjects, and Surgeon General Rupert Blue, of the United States Public Health Service. In the various section meetings, including the Laboratory, Health Officials', Vital Statistics, Sanitary Egineering, and Sociological Sections, many papers of equal merit, tho less popular in character, were presented.

Dr. G. F. Ruediger, formerly Director of the Public Health Laboratories of North Dakota, read a very interesting paper on the work he is doing in his new field at LaSalle, Illinois. Dr. Leverett D. Bristol, present Director of these laboratories, who represented the State and the University at the meeting, presented one on "Wound and Skin Dihphtheria as a Public Health Problem."

Dr. Wm. T. Sedgwick, Professor in the Massachusetts Institute of Tecnology, Boston, was elected President of the Association for the coming year and Rochester, New York, was chosen as the place for the meeting in 1915.

The University Radio Station During the month of December the University Radio Station conducted some very interesting experiments in long distance reception of wireless messages. For some months the station has been receiving war reports and various messages from both the east and west coast of the United States. These reports have been received even in the day-time, altho such long distance records are very much easier to make on night work. Messages received from Washington, D. C., for instance, average 100 times stronger late in the evening than they are at mid-day.

The success obtained in receiving the signals from the new Goldschmidt station at Tuckerton, New Jersey, and from the Poulsen station operated by the Federal Telegraph Co. at South San Francisco, has been due to two improvements at the University Raido Station. One consists in the equipment of the station with suitable devices for the tuning of very long waves. The other has been in the in-

vention of a new type of heterodyne receiver which has a most marvelous sensibility. The signals emitted by the new transoceanic power stations are continuous waves with a frequency of between 30,000 annd 60,000 oscillations per second. They cannot be received by ordinary radio apparatus for this type of wave. The new heterodyne receiver differs somewhat from the type of receiver usually used for this purpose and it is believed it is decidedly superior in sensitiveness to any other receiver yet devised.

The most recent achievement with this receiver at the University station has been the copying of war news sent out by the general staff of the German army from the high power station at Eilvese, Germany. This is a companion station to the station in Tuckerton, New Jersey. The Tuckerton station is distant only 1300 miles from Grand Forks. It is received here with very great intensity. The German station, on the other hand, is 4,300 miles from Grand Forks.

The fact that these signals are frequently not only audible but distinctly readable is a striking tribute to the sensibility of the new heterodyne receiver. These signals are sent out upon a wave length of between 9,000 and 10,000 meters and can be heard almost any day, altho they are not always loud enough to be legibly deciphered. It is interesting to note that a very interesting lesson in geography may be learned from a study of the path of these waves. The Eilvese station is not far from Hanover, Germany. The nearest direct line over the surface of the earth from Hanover to Grand Forks passes north of the British Isles very close to Iceland, crosses the tip of Greenland, grazes the northern end of Labrador, crosses James Bay and Hudson Bay and enters the United States only a short distance from Grand Forks. The extreme northerly path of these waves partially accounts for the ease of reception because the sunlight which disastrously effects transmission of wireless waves is at a low value thruout most of this path at this time of year. At least two other transoceanic stations have also been heard but they have not yet been identified.

The Athletic Situation The athletic situation at the university has shown a marked improvement during the past season, and this may be said in spite of the fact that the foot ball team has suffered a number of discouraging defeats. On the foundation laid last year it has been possible to build up a healthful spirit that has shown itself in a number of ways and that justifies the statement that this has been a successful season. Probably the most prominent feature of this spirit has been the continued and unquali-

fied support given to Coach Gill. The coach has been personally popular with the men on the team, and those who have followed his work are unanimous in the opinian that he has a thoro understanding of the principles of the game and a marked ability in imparting this information to others. The new scheme for selling season tickets has been very successful. Nearly every student in the institution purchased a ticket and attended the games. This has had two good effects; it increased the interest and greatly improved the cheering at the home games; and it enabled the athletic board to finance the season at a profit. Unless some unforseen difficulty arises, it will be possible to pay off the accumulated deficit by the end of the year and to start even next season.

The development of a foot ball team that will maintain a consistently high rank each season is a matter that requires time and a fairly permanent athletic policy. The new open style game is not learned in one season, and we can hope to be in a class with some of the conference teams only when the men entering the university are already well versed in the principles of the game. This will happen when the university is furnishing men who know real foot ball as coaches for the high school teams, and these men in turn are sanding their students to the University with a foundation on which a coach can work to some advantage. Until such time shall arrive, it will be much better not to schedule many games with the big state universities, but to confine our attention chiefly to establishing our undoubted supremacy among the schools of our own size and class. Games with big universities can be obtained only at the beginning of the season, frequently result in injuries that lower the efficiency of the team and are not of much educational value so early in the year.

The prospects for the season of 1915 seem good. Nearly all of the present varsity team expect to return, and there has been a large squad of reserves who will be active competitors for positions next year. Both the first and second teams have received a thoro training in the fundamentals this year, so that the next season may be started on a much more advanced type of foot ball. It is planned to continue practise in parts of the work thruout the year.

In accordance with the general plan of diversifying athletics, the period between Thanksgiving and Christmas was devoted to class basket ball games. These class games encourage a general interest and incidentnally give the coach an opportunity to try out a large number of candidates for the varsity team. A University

hockey team has been organized to play at the city skating rink and it is hoped that other winter sports may be developed.

A list of the foot ball games in 1914 and their scores is given below.

Sept.	26	Grand Forks High School	7	University	20
Oct.	3	University of Minnesota	28	"	6
"	10	Hamline University	3	"	10
"	17	Jamestown College	0	"	77
"	24	College of St. Thomas	7	"	6
"	31	University of South Dakota	30	"	3
Nov.	7	North Dakota A. C.	7	"	6
"	14	South Dakota State College	14	"	3
		Total points	96		128

National Association of State Universities The meeting of the National Association of State Universities takes place each year in November at Washington, D. C. Nearly all of the state universities are represented, usually in the person of their presidents and sometimes by deans of colleges. The meeting is looked upon as one of the important gatherings of the year. The programs deal with practical problems in education. This year the time was given over to organization of administrative offices and the curricula of schools of commerce in state universities.

The University of North Dakota has been represented for many years; President Merrifield attended the meetings during his term of office and President McVey has been present at the last five meetings.

On his way to the meeting of the Association this year President McVey lectured on the Making of a Town before the Wisconsin Federation of Womens' Clubs at Racine. On his return he visited the University of Cincinnati and Miami University. At Miami the President delivered the monthly Sunday address before the students, faculty, and citizens of Oxford. His subject was "Houses Built upon Sand."

Announcement

THE Quarterly Journal is a periodical maintained by the University of North Dakota. Its primary function is to represent the varied activities of the several colleges and departments of the University, tho contributions from other sources are welcomed when they are the fruitage of scientific research, literary investigation, or other form of constructive thought. Correspondence is solicited.

All communications should be addrest,

THE QUARTERLY JOURNAL,
University, North Dakota.

Editor's Bulletin Board

THE next number of the Quarterly Journal, the last of Volume V, which bids fair to be one of the most interesting yet issued, will come from the press at Commencement time. It will represent the political and social sciences. The leading article will be the Convocation address of Professor Chester B. Martin, exchange lecturer from the University of Manitoba, on "Law versus Prerogative: Evolution of British Democracy," given on March 20. We also have a very interesting answer to the timely question, "What is University Extension?" written by Mr. J. J. Pettijohn, formerly Director of our Extension Division, now occupying the same position in the University of Indiana. The remaining studies are by local men and represent the outcome of much thought, long experience, and careful investigation:

Recent Decisions of the Supreme Court of North Dakota.—O. G. Libby.

The Work of the Fourteenth Legislative Assembly of North Dakota.—Sveinbjorn Johnson.

The Germans in North Dakota.—Wm. G. Bek.

The Relation of Fraternities to the University.—E. B. Stephenson.

The Municipal Theater.—F. H. Koch.

The University of North Dakota

SUMMER SESSION, 1915. JUNE 21 TO JULY 31

THE COLLEGE SECTION offers instruction in many college departments including economics, education, history, languages, literature, philosophy, psychology, sociology, and the sciences. The University gives credit for work done during the Summer Session the same as during the regular university year.

SPECIAL FEATURES IN COLLEGE SUBJECTS:

Domestic Science: Advanced courses offered in both cooking and sewing, one course especially designed for teachers of the subject in high schools.

Education: The new school law requires professional equipment of all teachers; to meet the need courses are offered in nearly all of the leading phases of the subject including the history of education, adolescence, principles of education, and psychology.

Experimental Psychology: A well equipt laboratory offers opportunities for making interesting experiments in educational psychology. The work is planned especially for teachers.

Library Science: A course of lectures with opportunity for much apprentice work; should equip for successful handling of small libraries.

Manual Training: Excellent facilities for prospective teachers as well as for students doing regular work.

THE BIOLOGICAL STATION at Devils Lake, with all its facilities, will be open for work in botany, zoology, and physiography.

THE ELEMENTARY SECTION (June 28 to July 31) is under the management of a Board consisting of the State Superintendent, the President of the University and the County Superintendents of participating counties. It offers work of special interest to teachers in the rural schools, and also to those expecting to occupy grade positions in village and city systems. The State Board of Education accepts creditable work in lieu of examination in certificate subjects.

SPECIAL LECTURES of an educational and inspirational character are offered daily without extra charge. The speakers include eminent authorities in various fields of thought.

THE ENTIRE FACILITIES of the University are at the service of students during the six weeks of the Summer Session. Residence Halls for men and women. *A cool climate and a beautiful campus.* Expenses reduced to the minimum.

For further information, address

THE REGISTRAR, University, N. D.

The Quarterly Journal

VOLUME 5 APRIL, 1915 NUMBER 3

The Development of Some Recent Views in Regard to Electricity and Matter*

R. K. McCLUNG,

Assistant Professor of Physics, University of Manitoba

THE human mind is inclined to be conservative. It tends to resent the introduction of fundamental and basic ideas which are new, especially if the ideas to which they are opposed have been considered as firmly established for a considerable time. The attitude of the average mind towards scientific principles and theories forms no exception to this phase of human thought, as is instanced by many examples. For instance, there is the notable example, in the time of Galileo, of the opposition offered to the new idea that the earth is spherical instead of flat, such opposition being even carried to the point of persecution. Then again: everyone is familiar in more recent times with the strenuous opposition which has been offered and is still sometimes offered to the theory of evolutionary development.

This opposition to new scientific theories is not wholly confined to those who are more or less untrained in science but there have been some outstanding examples of highly trained scientific minds finding it very difficult to adopt certain new and startling conceptions. For instance, there is one very notable example of Lord Kelvin, whom everyone recognizes as a prince among the scientists of his day, refusing to accept the new theories put forward in connection with the phenomena of radio-activity. It is well known that he was a very strong disbeliever in the new theories put forth in connection with various phenomena of radio-activity by the early experimenters in that subject. In fact I am not sure that he ever became fully reconciled to these new conceptions, which everyone now accepts as being firmly established.

* An address delivered at the Convocation of the University of North Dakota, January 30, 1915, in the Exchange Lectureship with the University of Manitoba.

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However, notwithstanding that people are so loath to give up their old conceptions of things, the desire to discover the true workings of nature is stronger and this desire urges on investigation even tho the facts discovered may disturb the existing channels of thought. Thanks to this desire, we have the marvelous developments in scientific discovery and scientific thought which have taken place in recent years. And probably in no instance is this development more marked than along the lines of electricity. Altho wonderful developments have taken place in various special departments of electricity, there is probably no particular branch of electrical phenomena which has given us more entirely new conceptions of the constitution of matter and the nature of electricity itself than has the study of ionization and radio-activity. Research in this particular field has contributed more than probably any other towards the ultimate solution of the problem as to the true nature of electricity. Electricity is so intimately bound up with our daily activities and is something in which practically everyone is interested that it may be of interest to trace the recent developments in the particular phase of it which has thus enriched our knowledge and which has so wonderfully transformed so many of our old and fixt conceptions of nature.

Electric sparks or discharges are as old as the lightning flash but it is only within comparatively recent years that it has been found possible to reproduce similar electric sparks in the laboratory. During the first half of the last century it was found that an electric spark could be produced much more easily thru a closed glass tube from which most of the air had been removed, that is that the electric current travelled more easily thru a partial vacuum than thru the air under ordinary conditions. In the year 1859 Plücher, when investigating this phenomenon, discovered that under certain conditions in such a partial vacuum he obtained a peculiar kind of electrical rays which he called cathode rays because they originated at the cathode or negative pole inserted in the tube. After many investigations conducted by various experimenters it was finally proved that these rays consisted of extremely minute particles which were charged with electricity. In the year 1897 the actual mass of these tiny particles was mesured and the startling discovery was made that they were much smaller than the smallest particles then known to science. Up to that time the smallest division of matter was an atom. In order to give some conception of the minuteness of these particles let us imagine that we divide an ordinary ten cent piece, or dime, into one hundred parts and then divide each of these into a million parts, then take one of these parts and divide it again into a million parts, then

perform a similar division once more and then do the same thing a fourth time. We would then have something approximately the size of a hydrogen atom. This we probably think is small enough to have reached even the limit of the most speculative imagination. However, to still further tax our imagination, these minute cathode ray particles are only about one seventeen hundredth part of the atom of hydrogen. This tiny particle has been given the name electron.

This discovery of bodies smaller than atoms revolutionized the conceptions of scientists with regard to matter, and there was considerable opposition to these ideas. Chemists opposed the idea very strongly at first for the atomic theory on which chemical science is based appeared at the first to be in danger of being overthrown. This alarm, however, was quite unfounded as we still think of the molecule as made up of atoms but instead of considering the atom as a simple indivisible entity we now consider the atom as a more or less complex structure made up of a system of these electrons held together by a central nucleus. This new conception of the atom introduced a new phase into scientific thinking and marked the beginning of new methods of attacking many problems.

Many investigations of these cathode rays were made by various experimenters but they were limited to experiments inside sealed glass tubes as the rays could not penetrate the glass. Finally in 1895 it was observed by Professor Röntgen that some radiation effect was produced outside the glass tube. He observed that certain substances were caused to light up or fluoresce with bright colors when this radiation fell upon them. This radiation we now know by the name of Röntgen rays or X rays. This discovery opened up a wide field of inquiry, and probably no discovery in physical science of recent times has been of more human interest than this one on account of its application to surgery in the taking of photographs of the various parts of the human body. This particular phase of X rays we can not enter into now for want of time. These rays have wonderful electrical properties chief among which is their power to make the air about us a conductor of electricity. This was shown to be due to the production in the air by the action of the rays of electrically charged particles which can travel thru the air and carry the electricity. These little charged carriers are supposed to be produced by the partial breaking up of the molecule by the liberation of an electron which is negative and thus leaving the remainder of the molecule positive. The molecule is said to be ionized and this is the general process of the ionization of a gas. The discovery of these

facts caused rapid strides to be made along this particular line of investigation.

The property of these X rays by means of which they were originally discovered—namely, their power to produce fluorescence—led to another fundamental discovery. It had been known for a long time previous to the discovery of X rays that certain minerals when acted upon by light under proper conditions would light up or fluoresce with bright colors. This fact then led physicists to wonder whether there might be some relation between the fluorescent actions in the case of the X rays and in that of the fluorescent minerals. These minerals were investigated in the light of the new discoveries and one of them—namely, uranium—was found to exhibit the remarkable and hitherto unknown property of emitting rays which were similar in some respects to the X rays. This radiation was found to be given off continually without diminution as time went on. Like X rays these rays were capable of producing fluorescence and of causing the air to become a conductor of electricity. It was not long till other known substances of a similar nature were investigated and the well known substance thorium was found to possess the same property as uranium. Such substances as these which possest this spontaneous activity in emitting radiations of this kind were called radio-active substances, and these discoveries mark the beginning of our knowledge of the remarkable and fascinating subject of radio-activity. Not only did these substances show this remarkable radio-activity but great activity was shown among physicists and chemists, and a considerable number of investigators immediately set to work along this line. Among others were M. and Mme. Curie of Paris, the latter being a chemist, who thought it worth while to examine the mixture of minerals with which uranium was associated when taken in their natural state from the earth. As a result they discovered that some specimens showed a very remarkable activity, many times as great as anything yet observed in connection with any of the known substances. They came to the conclusion that there must be some unknown substance which was responsible for this remarkable activity. They therefore set to work to isolate this unknown substance by ordinary chemical means and were rewarded by obtaining the hitherto unknown substance which on account of its strong radio-active properties they called radium. The remarkable thing about this discovery was not only that this new and remarkable substance had been found, but still more that an absolutely new method of discovery had been brought to the aid of science. If it were not for the fact that radium was

capable of emitting this radiation which could be observed by electrical means even tho it was concealed in a mixture of other substances, this remarkable substance would in all probability have escaped the notice of chemists for a very long time to come for it was with very considerable labor and difficulty that it was isolated by chemical means. There was thus added to the already long list of powerful methods of scientific attack another one even more remarkable than those hitherto known.

Many new and interesting properties of these radio-active substances were discovered in rapid succession but these can not be entered upon at this time. It was found that these radiations consisted in part at least of tiny particles travelling with very high velocity, some being of the size of the electron and some of the size of the atom.

An investigation of the velocity of these particular particles along with their mass led to another entirely new and fundamental physical conception. Scientists had always been accustomed to associate the mass of a substance with the material of which the substance was composed and had always considered the mass and material as inseparable and as one and the same thing. However, these new radio-active particles revealed the fact that under some conditions the apparent mass of these particles depends in part at least on the speed with which they are travelling. We must here again reconstruct one of our most fundamental and deep-set conceptions with regard to matter. We must think of mass as not necessarily entirely due to the presence of matter but it may be due in part at least to the presence of electricity in motion. This new idea of associating mass with anything but ordinary matter is probably more revolutionary and far-reaching than any so far mentioned.

Discoveries in radio-activity followed one another with great rapidity. We have already referred to the fact that the radiations emitted by radium and other radio-active bodies consisted partly of small particles the size of electrons and partly of those of the size of atoms: if these particles are being constantly given off there must be some change continually taking place in these substances. It has been found that the atoms of these substances are gradually changing by the emission of one or more of these little electrons at a time. When an electron escapes from an atom what is left is a new atom and goes to form a new substance or new element with new properties. As this process of radiation goes on another electron escapes from this newly formed atom and a still further modification of the atom takes place and another new substance is formed. This process

has in some instances been found to pass thru several stages and a considerable number of substances are formed in succession. Here once again our older ideas of matter must be altered and replaced by new ideas. The atoms of all the substances that we were familiar with such as oxygen, nitrogen, carbon, gold, silver, iron, etc., we were accustomed to consider as fixt in their structure and unchangeable. The atom could enter into all sorts of combinations with other atoms but as an entity in itself it was the one thing above all that without exception remained constant. Now in the light of these recent discoveries we are forced to admit that this is not universally true but that some atoms do change. Of course it is not so difficult now to realize this for the way has been partially prepared for this new conception by the change in our ideas with regard to the structure of the atom itself. With the old atom of simple structure this change would have been practically impossible but admitting that the atom is complex in its internal structure it is not quite so difficult to conceive of this complex structure undergoing a change. Some of these changes are found to take place in comparatively short times extending over only a few hours or days while others are very slow extending over years and in some cases over hundreds of years. These latter changes are determined, of course, not by direct experiment but by calculation based on an accumulation of data obtained from direct experiment on the more rapidly changing atoms. If it were not for the rapid changes these slower ones would never have been detected. It is therofere not beyond the bounds of possibility that some of the atoms which we have always considered permanent may be undergoing a very slow change which is too slow to detect by any means at present known. Our conceptions with regard to the absolute permanency of matter in certain forms might therefore have to be still further modified.

I have endeavored to trace very briefly some of the outstanding developments in the views of scientists with regard to electricity and matter as a result of the great mass of investigations that have been made in the particular branch of electricity and radio-activity. The thought naturally arises, what is the result of these investigations and the consequent change of views. To the scientific investigator, who experiments purely for the love of investigation, the reward has been great indeed but the practical applications have not been wanting either. What greater practical result could one ask for than the application of X rays to surgery? Who can estimate the amount of suffering that has been relieved and the benefits conferred upon humanity by the use of X rays in photographing various parts of the

human body which may have become fractured, dislocated or disordered in various ways? The application of the radiation from radium has not as yet met with any marked degree of success but we can not tell what results may be obtained when a fuller knowledge of methods has been acquired. One of the most far-reaching benefits that have come from all these investigations is the deeper insight into the true nature of electricity itself which has been obtained. Everyone, I think, will admit that electricity is one of the most useful agents which we have in nature and one which has a most far-reaching application. It enters into our daily life now to such an extent that it has almost become a commonplace and we take it as a matter of course and do not usually stop to think of the various useful improvements which are made from time to time. Altho electricians have a very intimate knowledge of the practical applications of electricity and are quite proficient in the manipulation of it yet the fundamental problem of what electricity really is has yet to be solved. I think we are safe in asserting that there is no branch of physics or any other science which has helped as much towards the ultimate solution of this fundamental problem as has the study of ionization and radio-activity. As a result science is gradually making progress towards finding out the truth in this regard. And after all is not one of the real aims of scientific research the quest after truth as revealed by nature? And, thanks to the many careful investigations of the past quarter of a century, many more of the hitherto hidden secrets of nature have been revealed and the sum total of human knowledge greatly augmented.

The Double Audion Receiver*

ALBERT HOYT TAYLOR,

Professor of Physics, University of North Dakota

THE purpose of this paper is to outline briefly a method of using two audions as an amplifying receiver for the reception of continuous waves. It is, of course, quite evident that any type of detector may be used with the heterodyne receiver when the local high frequency is generated, as in the case of the Fessenden[1] receiver, by a special high frequency generator or a Poulson arc.

Recently the DeForest Radio Telephone and Telegraph Co. have put on the market a type of DeForest audion capable of producing continuous oscillations of great purity similar to those of the Poulsen arc, only of much less energy.

The writer has had no experience with this so-called ultra-audion but it seems perfectly obvious that this instrument could be used as a local high frequency generator in connection with any type of detector and receiving set as a heterodyne receiver for continuous waves. It would merely be necessary to couple very loosely to the aerial, much in the same manner as a buzzer test wave meter coupling, the oscillation circuit of the ultra-audion. The receiving set would then receive two continuous waves of any desired difference in wavelength and the pitch of the note produced in the telephone, which I may call the "beat" pitch, would be equal to the difference in the oscillation frequencies of the received continuous wave train and the ultra-audion circuit. If, in such a set up, the receiver consists of an ordinary audion we would get a two-fold amplification of the strength of the signals. In the first place, as has been pointed out by John L. Hogan, Jr.,[2] the heterodyne principle itself involves an amplification. If the strength of the received current be i_1 and the strength of the local high frequency current be i_2, the energy in the receiver is proportional in the one case to i_2^2 and in the other case to $(i_1 + i_2)^2$. If i_2 is considerably larger than i_1 the increment of energy due to the incoming signal will be $2i_1i_2$. The second source of amplification is due to the fact that, as has been repeatedly pointed out by DeForest, the audion, while giving a strictly quantitative response, nevertheless is a trigger device, since owing to the peculiar shape of its volt ampere characteristic it may be operated at

*This article was offered at the same time to the **Electrical World** and the **Quarterly Journal.** It appeared in the former in the issue of March 13, 1915.

1. See Fessenden's Patents.
2. Proceedings of the Institute of Radio Engineers, 1913, p. 75.

a point on this characteristic where the incoming signal releases a store of energy from the local high potential battery. It is this which gives the audion its superiority as a receiver.

The receiver used at this station is not, however, of this type. It is very much simpler, altho it has both of those amplification features and possibly one other amplification.

The receiving set for regular spark stations which the writer has been using for some time consists of two audions connected as shown in Figure I. This sketch of connections was suggested by an article by DeForest[3] in the London Electrician for November, 1913. The connection is, however, slightly different from the one suggested by DeForest inasmuch as the transformer secondary M leading to the second audion is in the DeForest sketches left open, whereas the writer has obtained better results by closing it thru a stopping

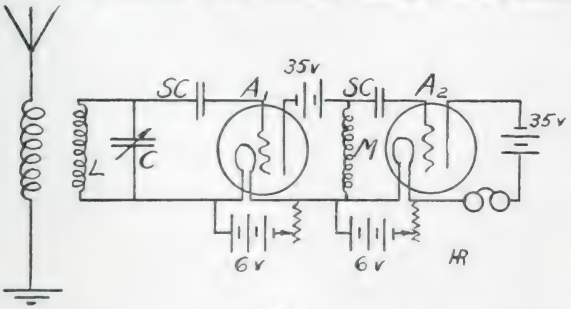


Fig. 1

condenser of very small capacity. The transformer used is the secondary of a one-half inch spark coil used as an auto-transformer. Under normal working conditions this arrangement constitutes an ampliphone. Shunted telephone readings have shown that the improvement in signal strength due to the addition of the second audion, while somewhat dependent upon the wave length averages from four to five fold. Whether this is as good as the amplification in the standard ampliphone, the writer is unable to say, altho it is enough to make the double audion or cascade connection decidedly worth while.

The action of this device under normal conditions is as follows: when receiving a spark station, the high frequency oscillations received in the first audion are converted into a series of unidirectional impulses. If the stopping condenser "S. C." in the audion circuit

3. Proceedings of the Institute of Radio Engineers, March, 1914.

is of large value these impulses will pass thru it bunched together in the form of low frequency groups corresponding to the spark pitch of the sending station. If, on the other hand, the stopping condenser "S. C." leading from the transformer to the second audion is of very small capacity a group frequency of the order, say, of 1000 per second, will be shut out. But on the other hand, the high frequency pulses will pass thru. The second audion in the first case will amplify the low frequency groups by the addition of local energy from its high potential battery. In the second case, it will amplify the individual high frequency pulses and deliver them to its telephone circuit smoothed out by the inductance of the telephone in low frequency groups.

A function of the transformer M is to provide a conducting path for the current from the high potential battery of audion No. 1 and at the same time to offer a sufficient impedence to avoid the short circuit of either low frequency groups or high frequency pulses. It must be remembered that if the amalgamation of the current from the first audion into low frequency pulses is to be avoided with certainty a stopping condenser to the second audion must be of very small capacity of the order of 5×10^{-4}Mf. With the ordinary spark station reception both audions are adjusted to the point of their volt-ampere characteristics where their sensibility is the maximum. As has been shown[4], there will be two points where the rate of change of the slope of the characteristic current of a normal audion will be a maximum corresponding to two different values of the voltage in the high potential audion circuit. If instead of varying this voltage the heating current of the audion is varied, the correspondence will be between two values of the heating current. It is usually more convenient to adjust the audions in this way. With this arrangement continuous oscillations will, of course, not be received unless there is simultaneously imprest upon the circuit a local high frequency in the manner already explained in the first part of this paper. It is possible, however, to find an adjustment of the audions where the local high frequency is produced within the receiving audions themselves, thus dispensing with the complicated generator generally necessary for heterodyne reception. It has been shown by Eccles[5] that the processes in many detectors are reversible, that is to say, if the reception of a continuous oscillation by an ordinary detector, as for instance the Galena crystal, results in the formation of a direct steady current thru telephones or galvanometer, this process can be reversed

4. E. W. Stone, Modern Electrics and Mechanics, March, 1914.
5. The Electrician, October, 1913.

by passing a current of the same magnitude in the opposite direction thru the crystal from the local battery and providing the crystal with a shunt circuit made up of inductance and capacity. This circuit will then contain feeble oscillations of a frequency determined by its inductance and capacity. In other words, it behaves like a Poulsen arc.

Now, in general, the audion does not show this effect.. In order for any detector to show this effect R^2 would have to be less than $\frac{4L}{C}$

It is well known that the Poulsen arc works best with relatively large inductance and small capacity in shunt. The resistance of the audion circuit, however, is so very high that under ordinary circumstances oscillations do not occur even altho the inductance is made as large as is possible while the capacity is reduced. It, however, the audion filament is burned at a higher brilliancy, just on the edge of the blue glow point, its resistance is greatly reduced and it will show this effect. The presence of the local high frequency oscillation is made evident by a hissing noise in the telephone. The writer has made experiments with the double audion which show that whenever the hissing noise appears the high frequency oscillation is usually in evidence and the explanation of the hissing effect is undoubtedly to be found in the presence of this extra high frequency current which may be of considerable magnitude.

Referring to Figure No. 1 it will be seen, therefore, that the inductance "L" must be large and the capacity "C" must be small altho their product must correspond approximately to the wave length to be received. The effective resistance between the grid and filament of audion No. 1 must be reduced by burning the audion at a somewhat higher brilliancy than that corresponding to the normal adjustment of maximum sensibility. Furthermore, in order for these high frequency oscillations thus produced in audion No. 1 to pass over into No. 2 by way of the plate of No. 1, the grid of No. 2, the hot filament of No. 2 and back to the hot filament of No. 1, it is necessary that the second audion also have a relatively low resistance. For the two bulbs one should therefore choose those which show the hissing effect. It is well known that all audion bulbs do not show this effect, the reason being undoubtedly either that the vacuum is not right or the distance between filament and grid is too great for them to possess a sufficiently low resistance to allow the development of this high frequency Poulsen-like oscillation.

Two ordinary X-grade audions have been used regularly for

some months at this station for ultraudion reception of various stations, including the two German stations at Nauen and Eilvese, distant 4300 miles from Grand Forks. In all, five different audion bulbs have been tested in various combinations and only one, a $7.50 bulb with a Hudson filament, was found which would not work in an ultraudion combination under suitable adjustment of voltage and heating current. The adjustment of the second audion is the most important.

In general, the voltage of the high potential batteries of both audions must be somewhat lower than the voltage necessary to give the best results when used for ordinary reception of spark stations. The same voltage in these circuits may be used for both types of reception, the adjustment from ultraudion reception to audion reception of spark stations being accomplished simply by changing the temperature of the two filaments. the higher temperature being used for the ultraudion reception. For audion reception, however, better results can be obtained with somewhat higher voltages in the high potential circuits. The best conditions for each audion must be worked out experimentally. Once determined they are exceedingly constant. Care must always be taken, however, that there are no dead cells of high resistance among the flashlight batteries which make up the high potential voltage referred to. This holds especially for the batteries belonging to the first audion because the local high frequency oscillation in the capacity inductance circuit of the receiving set which is connected to a hot filament on one side and thru a small stopping condenser to the grid on the other side will induce high frequency pulses in the circuit involving the plate of the first audion, the grid and hot filament of the second and back thru the first high potential battery to the hot filament of the first. If, by chance, one of the flashlight cells used in this battery has a high resistance its effect in damping out these pulses will be very serious.

In addition to the high frequency oscillation determined by the capacity and inductance in the receiving set there is, as is well known by all operators who have had experience with audions, another oscillation possible whose pitch is quite within the range of audibility. This is the electric siren effect mentioned in the bulletins of the DeForest Radio Telephone and Telegraph Co. The writer has not investigated this current in detail but the pitch of the note emitted would seem to depend on the inductance of the telephone and the capacity in the receiving circuit. It is also strikingly influenced by the natural free periods of the telephone membrane. This

audible note in the telephones is particularly liable to occur when two audions are connected in cascade as in the present arrangement. A partial explanation of this effect has been given by DeForest.[6]

The present paper is not concerned with the siren effect further than to note that the siren effect must be strictly avoided in ultraudion reception.

After several months of practical experience it has become evident that the best results with ultraudion reception are generally obtained with an adjustment which is very close to the adjustment which inevitably produces the siren effect, the siren effect occuring at a somewhat higher temperature of the filamnt of the second audion than is necessary for first class ultraudion reception.

The arrangement described was first tested out on the signals from the Federal Telegraph Co.'s station at South San Francisco, "KSS," at a wave length of approximately 7,500 meters.[7] This station has a remarkably constant wave length and uses a compensating wave differing about 5% from the signal wave. There was no difficulty in separating completely the two waves as the ultraudion receiver could be used with a most extraordinarily loose coupling and still receive the signals from "KSS" with great distinctness and purity. The pitch of the note can, of course, be regulated by the setting of the condenser placed in parallel with the secondary of the receiving transformer. If this circuit be exactly in tune with the incoming wave the beat pitch will be zero. At a wave length of 7,500 meters the frequency of the incoming oscillation is 40,000 per second. 1% deviation from perfect tuning will, therefore, give a beat pitch of 400 per second; 2%—800; 5%—2000. Between 1% and 3% asynchrony the loss in energy due to de-tuning seems to be negligible; at 5% there is a very decided loss. It seems best, therefore, to keep the beat pitch for stations of long wave length rather low. The audibility of South San Francisco, while varying slightly from day to day, averages approximately 200 with the ultraudion receiver; at the same time a much looser coupling can be used than with the tikker. The distance from South San Francisco to Grand Forks is approximately 1400 miles.

Recently signals have also been received from a Newcastle, Canada, station signing the call "VAN," and which seems to be attempting to establish communication with "PXU." This station is mentioned because it very frequently used a compensation wave which

6. Proceedings of the Institute of Radio Engineers, March, 1914.
7. The values of wave lengths given are only approximate as a wave meter had to be provided with multiplier and extrapolated to these long wave lengths.

differs so little from the sending wave that with the tikker it is practically impossible to separate the waves and to read the message. With the ultraudion receiver, it is, however, very easy. The two waves give two beat pitches. It is, therefore, very easy to read either of these pitches. If it is desired to suppress one of them the receiving condenser is changed until the beat pitch of the wave to be eliminated falls to zero. The other then has a rather low pitch but it is nevertheless perfectly easy to read. The wave length of this station is variable but has been frequently found at about 8,500 meters. The continuous wave received at this station with the greatest intensity is, of course, Tuckerton, New Jersey, "WGG," sending usually at about 8,000 meters. Even the arc equipment of this station, using two waves, is received with greater intensity than any other continuous wave. When the Goldschmidt alternater is used the signals come in on one wave only but the energy is not entirely broken, the signals consisting of variations in the intensity of the beat note.

The signals from this station are so powerful that they can very frequently be heard 50 feet distant from the receiving telephones.

Shortly after the action of this ultraudion receiver had been worked out the writer began to listen for the signals of the German stations at Nauen, "POZ," 10,000 meters; and Eilvese, "OUI," 7,800 meters. These stations are distant 4,300 miles from Grand Forks. They are now received practically every day from 2:00 P. M., Central time, on into the night. The most satisfactory intensity is obtained between 4:00 P. M. and 6:00 P. M., as later than that the strays frequently become so violent as to interfere with the reading of the signals. So far neither of these stations has been received earlier than 2:00 P. M. Central time. Usually Nauen with the longer wave is received with greater intensity.

It is to be noted that all three of the Goldschmidt equipments give a slight variation or swinging in the beat pitch. This is not of sufficient magnitude to produce any annoyance except when receiving some other station. For instance, if Tuckerton and South San Francisco are both sending at the same time, since the Tuckerton signals are so much more powerful, reception of South San Francisco is greatly facilitated if the beat pitch of Tuckerton is adjusted to zero. There is a sufficient difference in the wave length of the two stations so that under these conditions South San Francisco can still be read with ease. If, now, the wave of Tuckerton fluctuates slightly the signals from Tuckerton will now and then creep in as a very low guttural note. With a little attention to the adjustment of the

receiving condenser this can be easily corrected, as the beat pitch of the Goldschmidt station swings very slowly.

This type of ultraudion for obvious reasons works much better on rather long waves, the most satisfactory results having been obtained between 5,000 and 10,000 meters. The reason is quite evident if one considers the conditions necessary for the production of local oscillation, namely, R^2 must be less than $\frac{4L}{C}$. On attempting to adjust the receiver for wave lengths in the neighborhood of 3,000 meters of some of the west coast stations of the Federal Telegraph Co. considerable difficulty was experienced in producing the necessary local oscillation. This is evident from the relationship just mentioned. For short waves the inductance "L" has been considerably reduced. On the other hand, the capacity "C" may not be satisfactorily reduced to a desired mimimum because the stopping condenser itself furnishes a limited value. Moreover, if "C" be made too small the slightest movement of the hand in the neighborhood of the receiving apparatus will destroy the adjustment by changing the capacity of the set. This makes the adjustment very difficult for waves below 3,000 meters. The adjustment has, however, been carried out down to much shorter wave lengths. With a little practice the 3,000 meter stations mentioned can be received readily enough after 12:00 M. Central time.

The audibility of the German stations varies a good deal from day to day and even from hour to hour, especially around the sunset period, but at this time of the year it averages about 16.

The ultraudion receiver is, of course, effective also on damped oscillations, especially if we deal with long and feebly damped waves, as for instance those emitted by Bolinas, California, "KET," at about 6,500 meters. This station can be received any time in the afternoon and observations have most frequently been made at about 12:15 P. M. Central time, when Bolinas is apparently opening communication with the Hawaiian Islands. An interesting opportunity is here accorded to compare the operation and sensibility of the ordinary reception of the double audion, and the ultraudion reception. With the ordinary audion reception the signals of Bolinas are received with an average audibility of about 40. The note is a peculiar one inasmuch as it can be heard continuously in between the dots and dashes, the dots and dashes consisting of increments of intensity. The note is quite clear but is, nevertheless, typical of a spark station and nothing like the clear flute-like note obtained when the ultraudion reception is used on continuous waves.

When the ultraudion adjustment is made for "KET," the signals become exceedingly hoarse and rough, completely losing their tone quality but gaining tremendously in intensity, their audibility frequently reaching several hundred with the ultraudion adjustment.

Another Marconi station[8] not yet identified has frequently been observed at about 8,500 meters with the ultraudion, whereas this station can barely be heard at all with the ordinary adjustment. This is also true of the Hawaiian station, "KIE."

The ultraudion adjustment is easily, with the spark stations, shown to be at least 10 times as sensitive as the ordinary double audion adjustment. With spark stations, however, the loss of the musical quality of the note is a serious handicap and from the nature of the combination of the undamped local oscillation with the damped oscillation having a group frequency, as emitted by the spark station, the difficulty seems unavoidable. Similar experiments have been made upon the signals from Arlington at 2,500 meters. A tremendous gain in the intensity of the signals has been noted here as elsewhere; but the readability of the signals has not, in the opinion of the writer, been very materially increased owing to the loss of their musical quality. It is evident, however, from these experiments that the ultraudion reception of continuous waves is an exceedingly efficient one because the amplification is retained and the musical quality is absolutely perfect. Moreover, the pitch is under immediate control of the receiving operator.

In conclusion, a few comments on the possible ultraudion reception of very short waves may be in order. If a continuous oscillation of 300 meter wave lengths were possible, it would correspond to an oscillation frequency of 1,000,000 per second. A beat pitch of 1000 would correspond to a tuning in the receiving secondary to within one-tenth of one per cent of absolute synchrony. Asynchrony to the extent of 3% would produce a beat pitch of 30,000, practically to the limit of audibility and decidedly above the possibility of the ordinary telephone.

If, however, we consider the ultraudion reception of a damped wave of 300 meters, we can see that with a beat or ultraudion pitch of 30,000 the pitch actually heard in the telephone would be that of the group frequency of the spark station emitting the wave. At the same time the amplification inherent in any type of reception, as explained in the first part of this paper, would greatly increase the strength of the received signals. Some experiments have been

8. Probably Glace Bay, Nova Scotia. Its aerial is said to be directive eastward.

made recently at this station using the double audion burned at a great brilliancy for the reception of amateur stations "8PP," "8TI," "8FJ," and others, all of which are located in Ohio, distant 800 miles from this station. The intensity with which the signals of these amateurs have been received rising often to as high as an audibility of 100 to 150 and in some cases even higher, leads the writer to believe that the adjustment used for the audions was really an ultraudion adjustment. In any event the signals are not received at all when the temperature of the filament of the lower audion is kept at a lower point corresponding to the reception of other spark stations of somewhat longer wave length. This point will be further investigated.

The aerials used in the tests described in this paper were of capacity .0012 Mf. and .013 Mf. respectively. The smaller one consisting of 5 wires of phono-electric cable is 150 feet long, 12 feet wide and 85 feet in height. The other consists of 3 wires of seven strand phono-electric in a single span 800 feet long. It is 20 feet wide at the far end and 12 at the near end. The free end is 115 feet in height and points a little east of south. The lead-in is taken from the north end which is 60 feet in height. It is estimated that the height to the center of capacity of this aerial is 75 feet.

This aerial will tune to 3000 meters with a loose coupler whose primary is 5 inches in diameter and has 110 turns of No. 18 annunciator wire. Both primary and secondary are provided with very great loading coils with dead end switches. One of these loading coil units is variable so that a continuous adjustment may be had of the primary. A fine adjustment of the secondary is made by means of the rotary variable condenser across its terminals. This has a maximum capacity of .004 Mf. The signals from KSS, VAN, WGG, and KET can be received in the day time with either aerial with very satisfactory intensity. In fact the ultraudion brings in the signals of Tuckerton with such strength that they can be heard when the ground connection is removed. They can also be heard and distinctly read if, in addition to this, the aerial is disconnected but is touched with the bare hand of the operator. It is necessary to use the long aerial for the signals from POZ, Nauen; and OUI, Eilvese, Germany; and also for the Hawaiian stations.

Considering, however, the moderate height to the center of capacity of this aerial it is evident that the ultraudion is exceedingly sensitive.

Radio Sta., 9XN,
University of North Dakota

Water in Digestion and Nutrition

C. E. King,

Assistant Professor of Physiology, University of North Dakota

IT is not the aim of this paper to present material and arguments entirely new, but rather to state some of the latest conclusions of physiologists in regard to the part which water plays in the processes of digestion and nutrition.

Water constitutes approximately two-thirds of the body by weight, the parts and organs differing considerably in absolute percentage. The amount may, under normal conditions, vary somewhat, but only between comparatively narrow limits,—either an excess or an insufficiency quickly interferes with functional activity. Paradoxical as it may seem, water is frequently the most important factor, even if present in normal quantities, in causing the death of the cell, acting as a solvent and carrier for substances which so change protoplasm that it no longer exhibits "vital" phenomena. On the other hand, the relative absence of water may be the condition favoring survival. Such is the case with bacteria and seeds, but during these periods the processes of metabolism are at the lowest ebb consistent with existence. These facts have been stated in order to emphasize that water is an essential factor in all biological activity, the organism either dying or being passive in case it is deficient or absent.

The mechanism by means of which the water content of each cell is regulated is not fully understood, nor has the final word been spoken as to the part which it plays within the cell. Much valuable knowledge on this point has been gained thru the aid and agency of physical chemistry. In brief, within the cell, water appears to act primarily as a solvent and carrier.

The source of water is chiefly two-fold, that taken into the body by way of the alimentary tract and finding its way to the cells thru absorption and distribution by the blood stream, and that resulting from the oxidation of foodstuffs, chiefly carbohydrates and fats. The latter is by no means negligible altho no animal can long survive on the water produced in its own tissues. A pound of cane sugar contains enough hydrogen to yield about a half pint of water when completely oxidised, but this in turn would not be sufficient to dissolve a pound of sugar, dissolve the enzymes necessary to hydrolyse, and distribute the products to the cells of the body. Enough water must be available from other sources to dissolve and properly dilute the digestive enzymes, to dissolve and distribute the end products of digestion, and in the case of proteins to dissolve and carry away

the waste products, for it appears that in the oxidation of proteins not enough water is produced to properly dilute and carry away the nitrogenous waste.

Most of the water is lost thru the urine, altho considerable is lost thru the skin as sweat, thru the lungs as breath vapor, and some thru the feces. It is difficult to say just what amount represents a minimum on a mixed diet, but a summary of various views would indicate that for man on an average mixed diet, about a pint represents the minimum consistent with normal maintenance. Assuming this to be correct, it is evident that at least so much must find its way into the body daily. This represents about two glasses. Most people take more than this amount in some form, either as pure water and other drinks, or with more solid foods. The question naturally arises, if there is a minimum necessary to health, what are the effects of larger amounts, and is the time of drinking an item of importance?

In a paper of this scope it is impossible to deal with all phases of the water question. We shall confine ourselves largely to the physiological effects of drinking large quantities of water with meals, chiefly in the light of the extensive work of Hawk and his associates in this field.

It is a common experience to meet people who believe it harmful to drink even small quantities of water with their meals. This view is not confined entirely to the laity, but is strenuously advocated by some physicians. It may be well to open the discussion by quoting from the writings of a physician on this point.* "We can lay down the definite and certain rule that water should never be drunk at meals, and preferably not for at least one hour after the meal is eaten. The effect of drinking water while eating is, first, to artificially moisten the food thus hindering the normal and healthful flow of saliva and other digestive juices; secondly, to dilute the various juices to an abnormal extent; and thirdly to wash the food elements thru the stomach into the intestine before they have had time to become thoroughly liquefied and digested. The effect of this upon the welfare of the whole organism can only be described as direful."

Admittedly, the drinking of water or any liquid with meals artificially moistens the food. So does the addition of water in cooking. Many persons under the stress and strain of business, professional, and social activities shorten the time spent in eating by "washing" down unmasticated food. Probably in these cases the digestion time is lengthened, but if these persons cannot be educated to eat

* Quoted by Hawk.

more slowly, then the next best thing is to advise the addition of plenty of solvent.

In discussing this point, however, we are to assume that the food is masticated to a reasonable degree,—so liquefied that it can be swallowed with ease. The addition of water will shorten the mastication time. The questions at issue are, can water itself replace saliva as a solvent, does water stimulate or retard the flow of saliva, and is the digestive action of the saliva a factor of importance?

Pavlov has shown that water is not a stimulant to the salivary glands. In case nothing is taken but water it is difficult to see the need of saliva. He has also shown that dry foods are stronger stimulents than liquid or semiliquid foods. This is interpreted to mean that there is an adaptation on part of the salivary glands to the needs in the mouth, a condition of dryness demanding moisture for its correction. The parotid glands appear to be more highly specialized than the submaxillary or sublingual. Pavlov worked with dogs. These animals naturally bolt their food. Apparently the saliva cannot be of much importance in the early stages of digestion. We have collected data from four dogs and two cats with parotid fistulae,—the opening of Stenson's duct being turned out in the cheek so that the flow of saliva can be observed directly. Water alone in these animals provoked no secretion from the parotid glands, but meat in chunks, meat mush, and milk did. When these animals were given only one mouthful they swallowed it almost as soon as it struck the tongue. The flow of saliva was somewhat scanty, but if the material was held in the mouth for some time the flow became more rapid and soon reached a maximum rate. We are not able to say whether the rate reached was equal to that reached on stimulation by dry foods, but we have reason to doubt the sharp specificity claimed by Pavlov.

In man it can easily be shown that stimuli other than dryness suffice to produce activity in the parotid gland. The common method employed in physiological laboratories to collect the secretion of this gland for experimental purposes consists in stimulating the tongue with dilute acids, or solutions of salts such as sodium chloride or sodium bicarbonate. According to Pavlov such a procedure in the dog would not yield any secretion to speak of, but we find that in man it is easy to obtain an abundance of very active saliva. We have abundant reason to believe that in man the addition of water to the food while in the mouth, by its solvent action on the salts and extractives in the food facilitates rather than hinders the salivary reflex mechanism. It is even suggested that in the dog this might be true

provided the animal could be made to hold the mixture in the mouth long enough to allow the stimulus to act.

The fresh saliva of man contains a starch digesting enzyme called ptyalin, secreted largely by the parotid gland. The saliva of the dog and cat contains no such enzyme, or at most, only in traces, consequently the saliva in these animals can play no major part in the hydrolysis of starch. Neither man nor the lower animals named secrete a protein digesting enzyme into the mouth cavity. Dogs and cats suffer no digestive or nutritional disturbances even if the whole heat requirement is furnished by carbohydrates. In man, ptyalin is sometimes absent or far below the average in quantity. The writer has kept a record of the classes which have come under his instruction the last few years, and finds that on the average about one person in twenty secretes no ptyalin or a quantity far below the average. In no instances were there any digestive disturbances traceable to the deficiency, in fact the discovery was usually made in the laboratory and the student docked for faulty technique.

These facts suggest that salivary starch digestion is of little importance. If we profess skepticism on this point we are further troubled by facts gleaned from the study of conditions in animals other than those mentioned. The saliva of the cow, the sheep, and the goat contain no ptyalin, yet these animals are strong carbohydrate feeders. If it be objected that by these animals the starch is eaten in the raw state and that ptyalin acts so slowly on raw starch that it would be of no use to the animal, then the case of the rabbit again disturbs us. The saliva of this animal is as amylolytic as that of man, yet no rabbit has advanced far enough to cook his starch.

In the light of the foregoing discussion it appears that water alone is not a salivary stimulant, but that if added to food, by its solvent action may make available salivary stimulants. Assuming that the amount of saliva is decreased by its action, the solvent action of the water added would be as great as that of the lacking saliva. It appears that the digestive action of the saliva is of minor importance, which puts into the foreground its solvent action. These conclusions would hardly warrant the statement that so far as the digestive process in the mouth is concerned, the intake of much water is harmful.

The data on the effects of water on gastric secretion are more conclusive. It is well known that water taken into an otherwise empty stomach passes very rapidly into the intestine. Only slight absorption takes place in the stomach. The relatively short stay in the stomach suffices to arouse activity of the gastric glands. This

was shown as early as 1894 by Chighin working in Pavlov's laboratory. Lönnqvist, using the same methods, later confirmed this work. Both of these investigators worked with dogs, using the Pavlov pouch method. Recently Rehfuss and Hawk, using the Rehfuss tube to obtain samples of gastric juice, demonstrated that in the human the introduction of water into the empty stomach is followed by a copious secretion of a juice of high acidity. On the basis of these observations it is suggested that a glass of water taken at the beginning of a meal would accomplish the same end as a soup or bouillon, with the advantage that no sodium chloride would be introduced. We have obtained data, to be published later, that the sodium chloride content of the average soup served at eating houses selected at random is sufficiently large to considerably delay peptic digestion.

The secretion of gastric juice is dependent upon long reflexes thru the organs of taste and smell resulting in what is termed a psychic secretion, and upon a local chemical mechanism. Beaumont in his classical little book based on observations made on the hunter Alexis St. Martin, states that mechanical stimulation of the gastric mucosa excites the secretion of the gastric juice. This statement has not been confirmed by later investigations. Chemical excitation in the stomach appears to be the most important and efficient stimulus. This assumes that the chemical excitants must be in solution. The food contains many substances which can accomplish this. Enough water should be mixed with the food to accomplish the necessary solvent action.

It has also been shown that a copious secretion of an acid gastric juice leads to greater secretory activity of the pancreas, the activity of this organ depending largely upon a chemical substance called secretin, formed in the duodenal mucosa thru the agency of the hydrochloric acid coming over from the stomach. Water being a gastric stimulant, we should expect its ingestion to lead to activity of the pancreas. Hawk has brought forth evidence in support of this hypothesis. In our own work on urinary amylase we have shown that the ingestion of large quantities of water leads to a very marked increase of amylase in the urine. This enzyme being to a large degree pancreatic in origin, we have interpreted this result as meaning greater activity on part of the pancreas.

The experimental evidence cited gives us no ground for believing that water in large amounts with meals decreases the volume of the digestive juices, but rather points to an increase.

Does a large amount of water with meals dilute the enzymes too much? The answer to this question depends, perhaps, on what

we mean by large amount. It is evident that even the most enthusiastic water drinker would not constantly keep his mouth filled to its utmost capacity, nor his stomach. In Hawk's experiments the subjects were required to drink from 500c.c. to 1300c.c. in excess of the amount ordinarily taken. This means that during the course of a meal between one and one half and three pints of water were taken as drink.

Hawk found that the largest weight of starch could be digested by a definite amount of saliva, within a given time, if the saliva were diluted seven times. In our own work we have found the optimum to be about five. The difference is perhaps due to differences in methods of quantitative estimation of activity. Whatever may be the exact figures, it is evident that the saliva may be diluted considerably before its activity becomes impaired. We have already pointed out that the digestive action of the saliva is a factor of minor importance, and on this ground the effect of dilution does not greatly concern us. But assuming that we wish to preserve the digestive action on starch in the mouth, the intake, during the course of a meal of the amount of water above specified would seldom interfere. In the first place, the water is usually taken at intervals when there is little or no food in the mouth, and secondly if it is sipped while mastication is going on the capacity of the mouth will not permit a dilution exceeding the optimum. On an average, about 200c.c. of saliva are secreted during the course of a twenty minute meal. If this were collected and mixed with the maximum amount of water the resulting dilution would be 1:7.5, just slightly above the optimum as found by Hawk. This condition would be approximated if, during eating, water were continually sipped, which is seldom the case.

In this connection it may be well to observe that the temperature of the water is of more importance than the volume. The temperature of tap water varies somewhat, but averages about 15°C. The optimum temperature for ptyalin activity is about 38° C. On this basis, ice water is much more questionable than tap water.

The effect of dilution on the enzymes of the stomach and intestine has been shown to be similar to that on ptyalin. The capacity of the stomach will not permit the drinking of enough water with the average meal to dilute the enzymes beyond the optimum. The same is true of the intestine.

The beneficial effect of dilution upon enzyme activity is explained on the basis of dilution and more rapid removal of the end products of digestion. In test tube experiments the rate of activity gradually decreases until it becomes almost nil, altho considerable

substrate may be left. By dialysing out the end products the enzyme is "revived." Dilution accomplishes the same thing. In the digestive tract the end products are removed by absorption, more so in the intestine than in the stomach. The addition of water hastens the absorption of soluble substances. Hawk has shown that the nitrogenous waste products are eliminated earlier after large quantities of water. This indicates an earlier absorption, and a more rapid metabolism.

Does the intake of large quantities of water with meals hasten the evacuation of the stomach or, so to speak, wash the undigested food into the intestine?

Water itself when taken into an otherwise empty stomach leaves rapidly. In case food is present, the facts are not so well known. Conheim, by means of X-ray examinations after feeding with bismuth subnitrate, found that the water did not mix completely with the food, but left the stomach by way of a trough along the lesser curvature. Others maintain that when the stomach contains food the water mixes and leaves when the whole mass becomes acid enough to relax the pylorus. Pavlov has shown that the contact of solid foods with the mucosa of the stomach near the pylorus inhibits the opening of the pylorus. This mechanism is in part a safeguard against the passage of undissolved and undigested food.

The facts and interpretations so far presented, altho not always complete and conclusive, point to the conclusion that the drinking of large quantities of water with meals should not be harmful but beneficial. The extensive work of Hawk and his associates bears out this conclusion. This investigator experimented with a large number of men and lower animals, and invariably found that they did better on a large intake of water with their food than on a scanty one. With the men he found their weights and working power increased, as well as their physical condition improved.

The experiments just mentioned indicate that the intake of large quantities of water with meals brings about the following results: better gastric and intestinal digestion; increased protein metabolism; better utilization of fats and carbohydrates; accelerated absorption; decreased bacterial decomposition in the intestine; increase in body weight; and greater working efficiency. These results cannot be labeled as "direful."

Many special questions arise in a discussion of this type, but we can touch upon only one, viz: the comparison of distilled water with tap water for drinking purposes.

Hawk found the immediate effects of tap and distilled waters to be the same. Tap waters vary greatly, as do also bottled waters.

In cases of our Grand Forks water, we have been able to demonstrate an inhibitory effect upon starch digestion due to its alkalinity, but have no definite physiological data beyond this. Many people are prejudiced against distilled water, some because of its taste or rather tastelessness, and others because of its reputation as a cause of "gastric catarrh." The taste can be improved by the passage of oxygen thru the liquid, or by allowing it to stand in contact with pure air for a day or two after distillation. Hawk found no signs of gastric disturbances such as have been claimed and described. American seamen use distilled water for drinking purposes, and they are remarkably free from digestive disturbances.

Many of the ailments of later life are traceable to changes in the arteries such as thickening of the walls, deposition of calcium, leading to a loss of elasticity. This condition is known as arteriosclerosis, and its relation to the ailments of old age are well expressed in the saying, "a man is as old as his arteries." Many theories are afloat as to the cause of hardening of the arteries. Bacterial toxins, alcohol, nicotine, venereal diseases, too much protein, mineral waters, and strenuous living have all been arraigned.

In a recent number of the Medical Record, von Wedekind pointed out that hardening of the arteries is almost unknown among the American seamen. He explains this on the basis that they use distilled water for drinking purposes,—such water, in addition to being bacteria and salt free, has greater solvent power and consequently rids the system more rapidly of the waste products and injurious agents which bring on arterial changes. In his enthusiasm he proclaims that, "De Leon's Spring of Eternal Youth lies not hidden in Florida, but it bubbles always from the aseptic nozzle of the chilled scuttle-butt of an American battleship."

It appears to us that a broader comparative study is necessary before the above author's explanation can be fully accepted, but the health and longevity of our seamen make his contention worthy of deeper study.

The comparative value of distilled and tap water is difficult of determination, requiring years of observation on a large group of individuals. The experiments and observations of shorter duration appear favorable to distilled water. It is not improbable that distilled water prepared in the home will in a large mesure displace the bottled waters now so extensively used.

In conclusion, it appears that unless there are special abnormal conditions contraindicating it, a generous intake of water with the meals brings about results favorable to the organism. No appre-

ciable difference can be observed between the immediate effects of a good grade of tap water and distilled water; but owing to the possibility of tap water containing salts whose long continued intake may result in harm, it is suggested that the use of distilled water for drinking purposes should become more general.

BIBLIOGRAPHY

Pavlov: The Work of the Digestive Glands, 1910.
Chighin: Inaug.Diss., St. Petersburg, 1894.
Lönnqvist: Skand.Arch. Physiol., 1906, xviii, 223.
Hatrem and Hawk: Arch. Int. Med., 1910, vii, 610.
Rehfuss and Hawk: Jr. Am. Med. Ass'n., 1914, lxiii, 2088.
Rehfuss, Bergheim, and Hawk: Jr.Am.Med.Ass'n, 1914, lxiii,909.
Mattill and Hawk: Jr.Am.Chem.Soc., 1911, xxxii, 1999.
Mattill and Hawk: Jr.Am.Chem.Soc., 1911, xxxiii, 1978.
Wreath and Hawk: Jr.Am.Chem.Soc., 1911, xxxiii, 1601.
Mattill and Hawk: Jr.Am.Chem.Soc., 1911, xxxiii, 2019.
Sherwin and Hawk: Jr.Am.Chem.Soc., 1914, xxxvi, 1779.
Wills and Hawk: Jr.Am.Chem.Soc., 1914, xxxvi, 158.
Blatherwick and Hawk: Biochem .Bull., 1913, iii, 28.
Hawk: Biochem. Bull., 1913, iii, 420.
Orr: Biochem.Jr., 1914, viii, 520.
Howe, Mattill, and Hawk: Jr.Biol.Chem., 1912, xi, 103.
Fowler and Hawk: Jr.Exp.Med., 1910, xii, 388.
Wilson and Hawk: Jr.Am.Chem.Soc., 1914, xxxvi, No. 8.
von Wedekind: Med. Record, 1915, lxxxvii, 59.

Municipal Sewage and Its Care

LEVERETT DALE BRISTOL,

Professor of Bacteriology, and Director of the State Public Health Laboratories, University of North Dakota

DEFINITIONS

SEWAGE, or drainage, is composed chiefly of material coming from human habitations, such as kitchen and laundry washings, and the contents of water-closets. Other substances, such as the discharges from bakeshops, markets, hospitals, slaughter houses, and stables, may gain entrance to sewers. In a narrower sense, sewage is looked upon as human excreta such as skin washings, sputum, urine, and bowel discharges. "Sewage" is to be differentiated from "sewerage." The former refers to the liquid contents of sewers, while the latter term is used in relation to systems of sewers.

Because the excreta of man and the lower animals are among the chief carriers of disease, the proper disposal of sewage is one of the most important problems with which humanity has to deal.

The sewer has been described as "the direct continuation of the intestine." As such it may carry numerous disease producing bacteria and objectionable gases, altho the dangerous quality of these sewer gases has probably been exaggerated. In some instances very concentrated gases may give rise to acute poisoning, or to a lowering of the general vitality and bodily resistance. The popular belief that diseases such as typhoid fever, scarlet fever, and diphtheria may be contracted by inhaling sewer gas is erroneous. In fact the air of sewers is generally more free from dust and bacteria than is the outside air.

HISTORICAL

It may be of interest to know that the modern sewerage system is less than 100 years old. Rosenau says that "Up to 1815 the public drains of London were not permitted to receive excreta; in Boston fecal matters were rigidly excluded from the sewers until 1833; and in Paris this was the case even up to 1880." Chicago's sewerage system was designed in 1855, while Boston began active work along this line as late as 1875. Other cities have been equally slow in this respect. In Baltimore a satisfactory house drainage and sewerage system has been completed only recently. Is there any wonder that it has been passed by Cleveland for the honor of being the sixth largest city in the United States? A city must be up to date if

it is to grow, and there are no features which are more important in this progressiveness than proper house drainage, an adequate sewerage system, and sanitary sewage disposal.

Sewage Removal

The removal of sewage, which must necessarily precede its disposal, may be brought about in several different ways. Of these methods the most important are the water carriage system, and the dry system. The water carriage system requires the proper waste pipes and a sufficient water supply to keep them flushed. In this system the water-closet plays a most important part. These closets must be easy to clean, strong tho simple in construction, and easy to operate. They must have efficient traps to prevent objectionable sewer or drain air from entering the house.

The dry method of removal makes use of pails which are emptied at intervals and also includes the use of dry-earth closets, in which dry earth is thrown over each evacuation. Earth seems to act as a deodorizer and disintegrator of fecal matter. Usually urine is collected in a separate pail. Where the necessary water supply is lacking the dry earth system may be the best method. In districts where the winters are too cold for the use of water closets, this system is also of service. These closets may be placed in the house or in an out-house or privy.

Sewage Disposal

Sewage, or fecal matter, may be *disposed* of in three ways: (1) by putting it on the ground, (2) by burying it beneath the surface of the ground, and (3) by putting it into water. Professor Whipple would add a fourth place, namely—the air, thru the agencies of evaporation, combustion, and the carriage by flies.

The first is the primitive method, altho even in this enlightened age, we allow the railroad tracks of the country to be veritable paths of fecal matter. A further quotation from Dr. Whipple on this primitive method of disposal will illustrate the point. "It is done by wanderers in the woods and by travelers on our railroad trains, including those who travel in Pullman cars; it is done in the dark alleys of our streets and in our parks; it is common practice among the ignorant colored people of the hookworm regions of the South. * * * On our farms and in our villages we still put fecal matter upon the surface of the ground, only we store it first beneath the privy seat or in a pit and at our convenience spread it upon fields and gardens." The United States health authorities have been study-

ing this problem and have about reached the conclusion that a method in which heat is used for purification may solve the disposal problem as it relates to railroad cars and boats.

The second method of disposal, that of putting excreta beneath the surface of the ground, is much better, tho not ideal for it may be the means of polluting a well water supply. Are we to believe that dogs and cats, which carefully cover their excreta with dirt, have more developed sanitary instincts than human individuals who allow the above named primitive conditions to exist?

The third method is of the most recent development. Following *removal* by the water carriage system, water also has come to serve as a means of disposal. We have calmly gone about emptying our sewage into lakes and rivers, forgetting that our neighbors must drink this water. In some places steps have been taken to make the sewage as palatable and as free from danger for drinking purposes as possible, but is this the ideal? Should we in Grand Forks be required to drink the sewage of Crookston, Minnesota, even tho the tendency towards the self-purification of the Red Lake River, and our own efficient filtration plant, serve this to us in a safe and palatable form? Should we in Grand Forks contribute our raw excreta to our next neighbors down the river? The best methods of sewage disposal must be adapted to the local conditions. Thus the problem in the country differs from that of the small town or the large city.

The Privy. The privy has long been the chief agent for the disposal of fecal matter in the country. In the past this same innocent looking out-house has been the source of many fatal diseases. Pollution of wells by drainage from these privies, and the transportation of bacteria from them by flies have often resulted in typhoid fever. Health officials should give more attention to this source of disease, and should insist upon the use of the modern sanitary privy which does away with soil pollution by having receptacles or pails under the seats which may be removed from the privy by a rear trap door allowing the contents to be disposed of in a sanitary manner. It is of prime importance that the privy be thoroly protected if it is allowed to exist. A tight, well constructed vault is necessary to keep out flies and other insects. Good ventilation is also an essential feature. The privy should be so situated that drainage from it cannot get into a well. This necessitates a study of the character of the soil. the slope of the ground, and the distance from the well.

The Cesspool. The cesspool is also used to a large extent in rural, or isolated, communities. In some cases the cesspool is so built of loose bricks or stones that the liquid part of the sewage may drain away. Whether this is safe or not from the standpoint of well pollution again depends on the character of the soil and the distance between the cesspool and well. The solid part of the sewage must then be removed from time to time. Such material is often used as fertilizer on cultivated land, the process being not without dangerous results if used on garden vegetables such as lettuce and celery which are eaten in a raw condition.

Problem in Large Cities. The problem in large cities resolves itself into an adequate sewerage system for the disposal of sewage by water carriage. As mentioned before, many such systems empty the sewage into small streams, rivers, lakes, or the ocean. Some cities observe the Golden Rule and treat the sewage in such a way that it is purified before being discharged into public water supplies, while others believe their task accomplished if the sewage is disposed of even tho it be in a raw condition.

Problem in Small Cities. In villages and small cities the sewage disposal problem is of special interest and importance, for it is in such places where the changes must be brought about in the elimination of privies and cesspools and in the installation of an adequate system of sewers, sewage disposal and purification. This requires a special study of the entire local situation by an expert. It also means a considerable financial outlay. As a rule, the initial cost for construction must necessarily be large since any adequate system must take into consideration the future growth and needs of the community as well as those of the present. Small cities cannot afford to pay much for the operation and supervision of sewerage systems and purification plants. For this reason their construction must be as simple as possible and their operation require a minimum of attention.

Economics

The economic side of sewage disposal is an important feature to be considered. By some it is thought that all sewage should be used for the fertilization of fields and gardens, claiming that to throw it away is mere waste of public resources. Concerning this supposed waste Harrington has quoted Victor Hugo's interesting and significant remarks:—"Paris casts twenty-five million of francs annually into the sea; and we assert this without any metaphor. How so, and in what way? By day and night. For what object? For no

object. With what thought? Without thinking. With what object? None. By means of what organs? Its intestines. What are its intestines? Its sewers. Twenty-five millions are the most moderate of the approximate amounts given by the estimates of modern science. Science, after groping for a long time, knows now that the most fertilizing and effective manures is human manure. The Chinese, let us say it to our shame, knew this before we did; not a Chinese peasant—it is Eckelberg who states the fact—who goes to the city but brings at either end of his bamboo a bucket full of what we call filth. Thanks to the human manure, the soil in China is still as youthful as in the days of Abraham, and Chinese wheat yields just one hundred and twenty fold the sowing. There is no guano comparable in fertility to the detritus of a capital, and a large city is the strongest of stercoraries. To employ the town in manuring the plain would be certain success; for if gold be dung, on the other hand, our dung is gold.

"What is done with this golden dung? It is swept into the gulf. We send at a great expense fleets of ships to collect at the southern pole the guano of petrels and penguins, and cast into the sea the incalculable element of wealth which we have under our hand. All the human and animal manure which the world loses, if returned to land instead of being thrown into the sea, would suffice to nourish the world. Do you know what those piles of ordure are, collected at the corners of streets, those carts of mud carried off at night from the streets, the frightful barrels of the night-man, and the fetid streams of subterranean mud which the pavement conceals from you? All this is a flowering field, it is green grass, it is mint and thyme and sage, it is game, it is cattle, it is the satisfied lowing of heavy kine at night, it is perfumed hay, it is gilded wheat, it is bread on your table, it is warm blood in your veins, it is health, it is joy, it is life.

"So desires that mysterious creation, which is transformation of earth and transfiguration in heaven; restore this to the great crucible, and your abundance will issue from it, for the nutrition of the plains produces the nourishment of men. You are at liberty to lose this wealth and consider me ridiculous into the bargain; it would be the masterpiece of your ignorance. Statistics have calculated that France alone pours every year into the Atlantic a sum of half a milliard. Note this: with these five hundred millions, one-quarter of the expenses of the budget would be paid."

Of course, this is a greatly exaggerated statement. From one to five cents a ton is the value of sewage from the standpoint of

fertilizing powers. When sewage is disposed of by the modern water carriage system it is necessarily so diluted that to recover it in a concentrated form would cost more than it is worth.

Sewage Purification

The method of sewage treatment and purification depends on the kind of removal and the mode of disposal. If water is used for removal but not for disposal the sewage may be strained thru screens which remove the larger particles, and then subjected to a precipitation process, in which such materials as lime and ammonium sulphate, alum, and clay are used. The precipitated material is called sludge and is often used for fertilizing soil. Better disposal of sludge is to burn it or to use it in filling in low lands. Sewage carried by water may be treated chemically in tanks, one method involving intermittent treatment while the other is continuous. This method of disposal has been used to a great extent in England. A large amount of the suspended and organic material is thereby removed, but it has been found that water into which even such effluent is discharged is not safe for drinking purposes.

At one time it was thought that electricity might be of value in the purification of sewage, but in general it may be said that unsatisfactory results have attended its use. Electric currents passed thru the sewage liberate a certain amount of oxygen. It was supposed that this would effectively oxidize the organic matter of the sewage and thus render it harmless. It was found, however, that this was not practicable and that the only real good accomplished was the formation of iron oxide from the iron plates used in the process, resulting in merely a chemical precipitation of the sewage. More recently, electricity has been used in a salt solution to purify sewage. It has been demonstrated that even in this method it is not electricity as such which accomplishes the results, but rather that the important element is sodium hypochlorite which is formed by decomposition, thru electrolysis, of the salt solution.

The chief methods used in modern sewage disposal and purification are as follows:

1. *Irrigation,* or the simple discharge of sewage onto a small area of land for the fertilization of the soil. Dangerous bacteria and offensive material are largely destroyed thru the action of the air and sun.

2. *Broad irrigation,* which differs from the first method in the larger area of land which is covered. In both of these methods the

sewage is distributed by open drains or ditches from the middle of the section of land involved. Usually the sewage is discharged intermittently. From 2,000 to 15,000 or more gallons per acre may be applied daily. Irrigation methods are not well adapted to cold climates or clay soils. They are of special value in communities where there is a scarcity of water, and where available land is fairly cheap. Several California inland cities make use of irrigation methods. Such places as Colorado Springs (Colorado), Cheyenne (Wyoming), and Helena (Montana) have also used these methods with good results. The chief objection to irrigation methods is the rather remote possibility of causing such diseases as typhoid fever by the contamination in sewage fields of articles of food such as cabbage, lettuce, radishes, celery, and strawberries, which are usually eaten in an uncooked condition.

3. *Filtration,* in which the sewage is discharged onto land specially prepared for it, with no thought of fertilization. For the best results the soil should be sandy, or specially constructed sand filters may be used. The sewage is allowed to run onto these filtration beds intermittently. As much as 50,000 gallons per acre may be applied daily. The action depends upon the sinking of the liquid matter into the depths of the soil leaving the organic matter exposed to the action of the oxygen of the air and the sun's rays. Periodically these filter beds become clogged and a scraping of the surface is necessary. Many cities in the East have adopted this method of purification, and it has recently been put into operation in one or two Iowa towns.

4. *Subsurface irrigation,* a method adapted to summer dwellings or hotels and even of value for small towns. The sewage is allowed to flow below the surface of the ground thru open jointed pipes, these open joints permitting the sewage to enter the soil at various points. A thoro system of flushing is quite necessary for the success of this method, and a sandy soil is preferable to clay for the most satisfactory results.

5. *Sedimentation,* by the use of tanks of different kinds the solid part of sewage may be deposited, thus bringing about its mechanical clarification. While used at times as a final method of treatment this process should be only preparatory in nature. This method involves the use of (a) settling tanks, (b) digestion tanks and (c) septic tanks. The first is of simple construction and retains the sewage for a few hours allowing it to sediment. The digestion tank is a septic tank made with considerable depth, and having an upper

compartment for flowing sewage and a lower compartment for the digestion of the deposited solid matter, or sludge. The Imhoff tank is the best type of digestion tank. The septic tank, for the bacterial treatment or preparation of sewage, consists of two parts. In the first portion, or septic tank proper, certan bacteria cause the dissolving of the solid matter in the sewage, while in the second part, made up of several filter beds, other kinds of bacteria cause the oxidation of the sewage. While this method takes care of a large part of the organic matter, it does not always kill disease-producing germs which may be present in the sewage.

6. *Sprinkling or trickling filters,* these consist of crushed stone five or six feet deep, below which is a layer of gravel. The sewage is sprayed onto the surface of these filters intermittently allowing proper aeration and oxidation of the organic matter. It then percolates to the underdrains. This method is very efficient, removing a large percentage of the suspended matter and from 90 to 95 per cent of the bacteria. It is fairly cheap to maintain and does not depend on local soil conditions for its success. It has been adopted by several large cities after numerous trials of other methods.

7. Other methods for the bacterial treatment of sewage, such as the contact-bed system and coal filters, are open to criticism, that is—the effluent may contain large numbers of disease producing bacteria, and the sewage must, therefore, receive additional treatment before it is allowed to enter water supplies.

Most of the above named methods require that the sewage receive a final disinfection to destroy all of the bacteria. This chemical disinfection is particularly necessary when the sewage effluent is discharged into water supplies used for drinking purposes. Chloride of lime is the substance which is generally used, the quantity added depending on the character of the effluent.

Several things must be taken into account in choosing the method best adapted to the community. The cost of construction and operation is always of importance. The general character of the sewage, the population to be served, the proximity of other towns, and the character of the soil must also be studied before the best method can be chosen. In general, it may be said that where sandy soil is available the intermittent sand filtration is the most satisfactory method, otherwise the sprinkling filter is best.

In 1905 Fuller found that of 1524 cities and towns in the United States with a population over 3000 1100 had sewerage systems while only 90 had built purification works. While much progress

has been made in the last nine years, a large number of communities still discharge untreated sewage into the nearest body of water.

Stream Pollution

Associated very intimately with the problem of sewage disposal is that of the pollution of streams and other bodies of water. Inasmuch as the ocean water is not used for drinking purposes the large cities on the sea-coast are not so concerned in this matter. Sewage emptied into the ocean has at times obstructed navigation, is objectionable near coast resorts where bathing is indulged in, and near oyster beds, but otherwise gives rise to no ill effects. It is only when sewage is disposed of in the fresh water of rivers, lakes, and ponds that it becomes a menace to health. Sewage-polluted water supplies used for drinking purposes are the chief sources of typhoid fever, Asiatic cholera, and other diarrhoeal diseases. To prevent these diseases, the pollution of streams by untreated sewage should be forbidden by law. If such laws are not available, the people must be protected by adequate filtration and sterilization of the water supplies before they are used. Several states have adequate laws to prevent stream pollution. These laws are enforced by some communities while not heeded by others. A number of states, up to the present time, have failed to provide for such a protection of the public.

Stream Pollution in North Dakota. In North Dakota stream pollution is encouraged rather than prohibited. The old state law read: "Any city may empty or discharge its sewage into any river." This was amended in 1907 as follows: "Provided that in case there is no river accessible into which to discharge such system of sewage, the same may be discharged into any lake, coulee or slough, and in any of the latter cases a septic tank shall be employed for sewage from closets, kitchens, etc., before it is discharged into such lake, coulee or slough." The following cities of North Dakota use septic tanks for the treatment of sewage before it is discharged into streams: Bottineau, Carrington, Dickinson, Grafton, Minot, Jamestown, Enderlin, Lidgerwood, and Rugby. No other city in the state is known to have any method of sewage treatment.

Remedies

Some people believe that the pollution of streams is entirely a sociological and local problem. If the polluted stream serves in no possible way as a drinking water supply or nuisance to others, the local community may be allowed to wallow in its own filth to any extent desired. But if other individuals and communities must suf-

fer as a result of such pollution, then the problem becomes one of Public Health and demands control by adequate state laws. If other *states* must suffer—then federal legislation is required.

It is quite apparent also that federal legislation should be passed and enforced in relation to such rivers as the Mississippi and Missouri which are the sources of drinking water for, as well as the carriers of sewage from, several large cities in different states. It is the hope of many of us who specialize in Public Health and Preventive Medicine that some day we will have in this country an independent Federal Department of Health with a Secretary of Public Health in the President's Cabinet. With such a department, and with wise laws covering country-wide health problems, a new era will appear in which stream pollution and other unsanitary practices will be absolutely prohibited in all parts of the United States.

Sewage and Shell-fish

Sewage pollution of water is dangerous from another standpoint. It is now recognized that shell-fish, particularly oysters, may be contaminated with disease-producing germs, such as the typhoid bacillus, thru sewage pollution of the water in which they live. The chief danger is in the eating of raw oysters, for we know that thoro cooking serves to kill all bacteria that may be present.

This important problem was first worked out, some years ago, in the writer's Alma Mater, Wesleyan University. The institution suffered an epidemic of typhoid fever. Naturally the drinking water supply first came under suspicion. However, after careful examination, this possible source of the disease was excluded from further consideration. The ice and milk supplies as well as ice-cream, butter, and raw fruit and vegetables were investigated and found to be perfectly innocent. Because all of the cases of typhoid, about twenty-five in number, developed at practically the same time in several different fraternity houses, but not in the city or college at large, it was believed that something which had been used in common by these different fraternities at about the same time was the source of the disease. It was first found that the fraternities of the college had given banquets on the same evening at about the time the disease must have been contracted. Upon investigation of the articles of food used in common by the fraternities everything was excluded except raw oysters, which had come from the same dealer in each case. Further study showed that these oysters had been grown in the deep water of Long Island Sound and that they had been removed subsequently to the fresh water of a small river for "fattening." This

so-called "fattening" is due to the fact that the oysters absorb large amounts of fresh water and consequently become swollen. In the immediate vicinity of these beds where the oysters were "fattened" several private sewers had their outlets. One of these private sewers, discharging untreated sewage, was found to have its source in a house where two severe cases of typhoid fever existed. From these facts, and from subsequent bacteriological tests, it was concluded that the oysters had carried the typhoid infection.

Following this demonstration the public became unduly suspicious of oysters and the oyster dealers all over the country complained that their business had greatly decreased. As a result, those coast states interested in the growing of oysters are now engaged in an inspection of all oyster beds, with the object of prohibiting their contamination by sewage. At the present time it may be said that the raw oyster is no more dangerous to eat than any uncooked food which may be contaminated. Thoro cooking removes all possibility of danger from this source.

Sewage Disposal in Grand Forks

To return to our subject, let us now consider the local situation so far as sewage disposal is concerned. Little need be said of what Grand Forks *is doing* in respect to sewage disposal but much could be written as to what is *might* do. This city not only empties her sewage, in a raw condition, into the Red River but does it in seven different places. In other words, there are seven trunk sewers which empty their contents into the river.

Table I gives the approximate localities of the several outlets, the dates of construction of the trunk sewers and of the laterals.

TABLE I

Location of Grand Forks Sewer Outlets into Red River, and dates of Sewer Construction

Location of Outlets	Dates of Construction	
	Trunks	Laterals
DeMers Avenue { Old	1882	1883-1905
DeMers Avenue { New	1909	1909-1910
University Avenue	1891	1892-1899
Belmont Avenue	1891	1891-1907
Lanark Avenue	1899	1899-1914
Griggs Avenue	1901	1902-1911
Elm Avenue	1907	1907
Riverside Park	1909	1910-1914

The local sewers carry storm water as well as sewage. Their efficiency is somewhat hindered at times because of the fact that our ground is so level the element of gravity in the flow of sewage is not as possible as it is in hilly districts. For this reason the sewers require much more flushing or pumping than is usually necessary.

University Sewage. A word or two regarding the disposal of sewage from the University may be of interest. During the early days of the University's existence sewage from the original buildings was emptied into the English Coulee at different points in the campus. In 1899 a drain was put in which carried most of it to a point about one quarter of a mile north of the campus where it was emptied into the coulee. In 1907 the Legislature appropriated sufficient money to build the present sewer which connects with the Grand Forks system. This sewer runs under the alley just north of, and parallel to, University Avenue and empties into the city trunk sewer which runs north under Eshelman Avenue, Griggs Avenue, and thence into the river. Because of insufficient gravity flow the University maintains a small pump house just east of University Park. The pump is operated automatically by electricity from the University power house, with a small gasoline engine for emergency purposes.

Inasmuch as this paper is a general and local survey and not a discussion of what method, if any should be adopted to meet the local situation, no attempt will be made to go into the subject of the desirability for, or the nature of, such local remedies. Suffice it to say that the health of the people of Grand Forks is protected, from the standpoint of communicable diseases, with its Isolation Hospital; her foods are rigidly inspected by competent authorities; her air, the gift of a kind Providence, is pure; her water supply is made safe by a filtration plant which is effective so long as it is kept in good repair, and her garbage and refuse are now taken care of in a sanitary manner. The feature of municipal sanitation which is lacking in Grand Forks is an adequate purification of her sewage.

The Situation in Other Small Cities

It is interesting and important to know what other cities, about the size of Grand Forks, are doing in this regard. Letters were sent to sixty different cities with populations ranging from 10,000 to 20,000 in three representative Eastern states (New York, Massachusetts and Connecticut) and five Western states (Iowa, Minnesota, Montana, North Dakota, and South Dakota). Table II gives

a summary of the sewage disposal problem in the towns from which answers were received:

TABLE II.

Summary of Sewage Disposal Problem in Thirty Small Cities

Town	Population	Sewer System	Method of Disposal	Purification with Disposal	Remarks
New York—					
1. Ithaca	14802	Yes	Into inlet of Cayuga Lake	Partial	Sewage delivered into septic tank before being discharged into lake.
2. Little Falls	12273	Yes	Into Mohawk River	No	
3. White Plains	15924	Yes	Into the Hudson River	No	Trunk sewer 15 miles long
4. Glens Falls	15243	Yes	Empties into a Crevasse of Limestone Deposit	No	Gravity flow of underground outlet.
5. Saratoga Springs	12693	Yes		Partial	Cameron Septic Tank System
6. Olean	14743	Yes	Into River	Partial	Two Disposal Plants
Massachusetts—					
1. Greenfield	10427	Yes	Into Green River	No	Sewage screened
2. Framingham	12948	Yes	Effluent into Merrimac River	Yes	Sand filtration
3. Plymouth	12141	Yes	Into Ocean Harbor	No	Tides carry sewage out to sea
4. Westfield	16044	Yes	Into Westfield and Little Rivers	No	
5. Melrose	15715	Yes	Into Metropolitan (Boston Harbor) system	No	
Connecticut—					
1. Ansonia	15152	Yes	Into Tide Water of Long Island Sound	No	Sewerage system completed this year. Sewage carried 3 miles before emptying into Sound
2. Bristol	13502	Yes	Effluent into River	Yes	Gravity flow to a sand filtration plant
3. Greenwich	16463	Partial	Into Long Island Sound, Byram and Mianus Rivers	No	Now working on new sewage disposal plant and system of purification
4. Middletown	20749	Yes	Into Connecticut River	No	A new disposal plant being finished.
5. Torrington	16840	Yes	Into the Naugatuck River	No	
6. Willimantic	11230	Yes	Into a River	No	
7. Wallingford	11155	Yes	Quinnipiac River	No	Planning Septic Tank and Sand Filters
8. New London	19659	Yes	Into Harbor	No	Carried out by Tide

Town	Population	Sewer System	Method of Disposal	Purification with Disposal	Remarks
Iowa—					
1. Boone	10347	Yes	Into Creek	No	Creek 1 mile from city. Figuring on putting in disposal plant.
2. Fort Dodge	15543	Yes	Into DesMoines River	No	
3. Iowa City	10091	Yes	Iowa River	No	
4. Keokuk	14008	Yes	Into Mississippi River	No	
5. Mason City	11230	Yes	Into Lime Creek	No	Constructing intercepting sewers, and planning a disposal plant for purification
Minnesota—					
1. St. Cloud	10600	Yes	Into Mississippi River	No	
Montana—					
1. Billings	10031	Yes	Into Yellowstone River	No	Gravity flow about 2 miles to river
North Dakota—					
1. Devils Lake	5157	Yes	Into Devils Lake Bed	No	
2. Fargo	14331	Yes	Into Red River	No	Three Trunk Sewers
South Dakota—					
1. Aberdeen	10753	Yes	Effluent into junction of Moccasin and Foote Creeks	Yes	Sprinkling filter. Also sedimentation tank, sludge filter and final settling tank
2. Sioux Falls	14094	Yes	Into Sioux River	No	

Of the 30 cities studied, 29 have sewer systems while the other is at present working on such a system; 18 empty their sewage into rivers, 3 into creeks, 5 into tide water, 2 into lakes, 1 into underground outlet, while 1 does not empty into any body of water: 24 have no system of purification of sewage, 3 have partial, and only 3 have adequate plants for purification. Of the 24 which at present have no method of purification 5 are considering, or actually building plants. Of the 3 cities with adequate methods 2 have sand filtration plants while the other has built a sprinkling filter combined with settling tanks.

From this study it may be seen that Grand Forks is doing as well as the majority of towns of her size in regard to sewage disposal and purification. There are a few progressive small towns which are setting the pace. Will it not be only a question of time when others will have to follow? In conclusion we must agree that "the actual practice of sewage disposal still lags far behind its theoretical possibilities."

Science and Religion in Evolution

EDWARD P. ROBERTSON,

President of Wesley College

EVOLUTION is an interpretation of cosmic process. The word itself implies its own definition, and is too restive to yield to any other at present; for the hypothesis itself is in process of evolution and no one can yet name all its properties or determine its compass and extent.

"A still small voice was heard above the roar and confusion of the nineteenth century. It was the voice of Darwin proclaiming a new law for man and nature. It was a voice that stirred the topmost branches of the tree of knowledge. It moved like a viewless sound through all the courts and corridors of civilization. It caught like an electric spark in the understandings of men, and the prevailing crude opinions of the race respecting the phenomena of life were transformed into sublime and beautiful order." So beautifully writes Ridpath, and here we might find rest, were it not for Ridpath's next sentence: "But Darwin himself was the product of his age. He was the son of England and humanity." To know what Darwin meant know Darwin; to know Darwin know his age, his country, humanity.

Andrew D. White finds "the various groups of men devoted to the physical sciences all converging toward the proofs that the Universe, as we at present know it, is the result of an evolutionary process—that is, of the gradual working of physical laws upon an early condition of matter; on the other hand," he continues, "we have other great groups of men devoted to historical, philological, and archaeological science whose researches all converge toward the conclusion that our sacred accounts of creation were the result of an evolution from an early chaos of rude opinion."

This definition leaves the subject about as vague as before. "The gradual working of physical laws upon an early condition of matter" is too complex to stand as final definition. Perhaps the best working definition of evolution is that given by Le Conte: "Evolution is continuous progressive change, according to certain laws and by means of resident forces." It is well to note that the terms here employed are after all but the algebraic x, y, z: x=progressive change, y= certain laws, z=resident forces, each signifying unknown quantity.

What are the "resident forces"? What are "certain laws"? How many are there? What is the origin and ultimate, or com-

pass and extent, of "progressive change"? It is needless to remark that to each of these questions various answers have been given. While walking one day, holding the hand of a four-year-old boy, a half-grown chicken, frightened at the approach of a minister, ran across the yard. In an instant two eyes looked up to mine, and quick came the question, "Where did the first hen come from?"

That short question called for the natural history of the universe. It was the question of a child. The same question in another form comes to the mind of every man. I might have said, "The first hen came by continuous progressive change according to certain laws and by means of resident forces." If so I might have answered correctly, indeed I think so; but I imagine the next question would have been, "What do you mean by that?" The explanations would imply intellectual grasp beyond the child's reach or mine, and to him would not explain. I answered, "God made the first hen," and the child was satisfied. So was I, for I believe this answer also was correct.

Please note the question was not of the origin of this chick, but of the "first hen." Some would consider evolution as process only and disallow the legitimacy of questions of origin and destiny; but surely every term in a definition is a ligitimate subject of inquiry: "progressive change"—from what to what? "Certain laws"—what are laws and who conceived and ordained them? What are "forces" and how do they "reside"?

Do such questions evidence a childish mind? Listen to Tyndall musing upon the Matterhorn as he traced the signs of age and decay upon its weather beaten brow. "Thought," said he, "naturally ran back to its remote origin and sculpture, nor did thought halt here, but wandered on through molten worlds to that nebulous haze which philosophers have regarded, and with good reason, as the proximate source of all material things. I tried to look at this universal cloud, containing within itself the prediction of all that has since occurred; I tried to imagine it as the seat of those forces whose action was to issue in solar and stellar systems, and all that they involve. Did that formless fog contain potentially the sadness with which I regarded the Matterhorn? Did the thought which now ran back to it simply return to its primeval home? If so had we not better recast our definition of matter and force; for if life and thought be the very flower of both, any definition which omits life and thought must be inadequate if not untrue. Are questions like these warranted? Why not? If the final goal of man has not yet been attained; if his development has not yet been arrested, who can

say that such yearnings and questionings are not necessary to the opening of a finer vision, to the budding and growth of diviner powers? When I look at the heavens and the earth, at my own body, at my strength and weakness of mind, even at these ponderings, and ask myself, is there no being or thing in the universe that knows more about these matters than I do? What is my answer?"

This is but the child's question elevated and extended by the trained imagination of this eminent scientist. If such questions are not warranted, then are all men sinners, for all yearn with the same longing to know origin and destiny. I listen to hear Tyndall's answer—"I yearn and guess, but may not know." I am not satisfied. I take my stand beside another, not so well trained in physical analysis, but with other powers of greater sweep. I hear him answer the same questions implied. "The heavens declare the glory of God, and the firmament showeth his handiwork. The testimony of the Lord is sure, making wise the simple."

A prominent naturalist is quoted as saying that in every new path of physical research he found the sign, "No thoroughfare—Moses." On the other hand one may reply that across the way of these yearnings of the soul to discover its whence and whither, materialistic science has posted the sign, "No thoroughfare." Self-appointed sentinels of both classes have attempted to guard these signs, and encounters not always bloodless have resulted. You and I will deny the right of any mortal to so bar the way of research or aspiration, but the rather will insist that any hypothesis submitted as an adequate interpretation of cosmic process shall make provision for legitimate answer to be discovered, not only to questions of physical process, but to all these varied questionings of the human soul. Says Agassiz, "A physical fact is as sacred as a moral principle. Our own nature demands from us this double allegiance." It was a scientist of first rank who spoke these words, and a religionist may welcome the putting of them, for no truer words were ever uttered. By the very nature of the case, some truths are to be found by physical analysis. The theologian may not wisely be jealous of him who would seek truth with scalpel and crucible—he too is a priest. Nor should one thus searching scorn him who would classify the phenomena of the spiritual life and attempt an answer to those transcendant questions that give rise to religion, for he too is ascientist. All truth is one at the center and by whatever path the devout seeker approaches he should expect to meet at the center all who have come as true votaries from the whole wide world of human interest.

I flatter myself that I am in full sympathy with this conception of the case, as implied in my theme. My specific task is to discover the mutual relationship of what are popularly termed "science" and "religion" within the scope of the evolutionary hypothesis. In this conception we assume that the so-called physical universe comes first to our view in some nebulous condition which had within it potentially and prophetically all that has come from it by continuous progressive change, uniform or otherwise. As applied to human history this hypothesis assumes in general the view of Ridpath that "history is the aggregate of human forces acting under law moving invisibly—but with visible phenomena—from ancient savagery as a beginning to the ultimate perfection of mankind as an end."

It is difficult to define science or religion. In general, science is research thru physical analysis and observation of physical phenomena, and its method is popularly supposed to be inductive.

Religion assumes divine agency as first cause of all that is, and that the Divine, by the revelation of himself in his works and to the moral sense of man, renders possible the immediate apprehension of truth in ideals. The process is popularly supposed to be deductive.

Science is engaged with physical or secondary causes and stops this side of origin and this side of final destiny. Religion treats of first cause and so of origin and destiny. Religion proceeds from the ideal to the experienced; science from the experienced to the ideal.—but this contrast must not be considered as always true, for either pure induction or pure deduction is rarely if ever pursued. Rigid induction disallows to the imagination any function, but Tyndall assures us that the scientific investigator proceeds by combining intuition and verification. "The force of intellectual penetration," said he, "into this penumbral shade which surrounds actual knowledge, is not, as some seem to think, dependent upon method, but upon the genius of the investigator. There is, however, no genius so gifted as not to need control and verification. The profoundest minds know that nature's ways are not at all times their ways, and that the brightest flashes in the world of thought are incomplete until they have been proved to have their counterpart in the world of fact. Thus the vocation of the true experimentalist may be defined as the continued exercise of spiritual insight, and its incessant correction and realization."

Instead, therefore, of science presenting always a solid front of truth, it is in a sense hypothetical at every stage and we are prepared

for what Dana said when asked how long before a book on science would be out of date. "As soon as it leaves the press," said he. In a sense, the same is true of any statement of religious belief.

There is also the mathematical process of scientific research, when a hypothetical case is submitted to mathematical test, as in a theorem of geometry. In this instance the supposed is tested by the ideal, for pure mathematics, the exact science, exists only in the ideal and does not change. Mr. Huxley mentions the fact that the geometries studied today were prepared for the schools of Alexandria many centuries ago. There is no change, for here is a conception of ultimate truth that becomes a guide and corrective in all research and structural actvivity. If Buckle had noted the function of pure mathematics in the realm of physical research and industry he might have been saved the stupendous blunder of asserting that religion could not be a factor in human progress because the statement of primary religious principles had remained practically unchanged. "Thou shalt not kill," "Thou shalt not steal," are permanent in statement, to be sure, but have progressive interpretation in the advance of civilization. Tyndall's description of the scientific investigator will quite well apply to method in religion, and I am ready to accept also Tyndall's definition of history as "the record of a vast experimental investigation, of a search by man after the best conditions of existence," and agree with Ridpath: "By history we do not mean the puny record of events made by scribe or chronicler, but the events themselves in their majestic sweep across the landscape of the world."

In this vast experimental investigation mind has not run mad, but has been true to its nature and worked according to an hypothesis that spans the ages and so transcends all others that in itself we may expect to find the thought harmony of which we have dreamed.

As an approach to this end let us note that physical science lays no claim to ultimate knowledge of first cause, or final destiny, of what is. Scientists admit this frankly. Says Huxley: "I find no record of the commencement of life and therefore I am devoid of any means of forming a definite conclusion as to the conditions of its appearance. But if it were given me to look beyond the abyss of time, when the earth was passing through physical and chemical conditions which it can no more see again than a man can recall his infancy, I should expect to be a witness of living protoplasm from not living matter. I have no right to call my opinion anything but an act of philosophical faith."

Religion and science part company here—science to bow in awe

before a mystery of which she knows not the secret and into whose domain science may not enter; religion to pass on as if by a familiar way, for "philosophical faith" is the accustomed method of religion. Within the space of human history science and religion have had varied and varying relationship. This has been defined by Draper as "conflict," by Andrew D. White as a "Warfare of Science with Theology." He would soften the matter by singling out theology and considering it apart from religion and seems erroneously to hold that religion will yield to such treatment. The result is a monumental work, but it yet remains to be determined whether it shall stand more as a monument to the phenomenal research its data evidences or the amazing lack of philosophical poise in so eminent a scholar. The title implies that science has gathered beneath its standard a united band who faced in hostile array another band united under the banner of theology, and that between these opposing forces ceaseless conflict has been waged.

Let us see. Conflict there has been, and is, indeed, but how single out the combatants? Here a scientist engages a theologian. There a merry war goes on between theologian and theologian, while scientist falls on scientist with hostile intent. White's classification will not answer the case.

The past generation contained three of the greatest scientists the world has known, Darwin, Agassiz, and Humboldt. Darwin put Agassiz at the head of the list of scientists of England and America and considered him equal to three, but Agassiz directly opposed Darwin's conclusions, declaring that he thought he knew enough of comparative anatomy to abandon forever the idea of the transformation of the organs of one type into those of another.' On the other hand, Darwin accepted Agassiz's glacier theory which Humboldt rejected.

In the matter of biogenesis and abiogenesis there was the sharpest conflict. Buffon and Needham appeared for a time to have triumphantly established abiogenesis, the spontaneous generation of life. Other scientists took the opposite view and won the victory. Huxley records the issue in the following words: "The great tragedy of science—the slaying of a beautiful hypothesis by an ugly fact—which is so constantly being enacted under the eyes of philosophers, was played almost immediately for the benefit of Buffon and Needham." Haeckel employs almost the entire preface to his third edition of his "Descent of Man" in answering hostile critics, not theologians, but evolutionary scientists like himself. Illustrations without number could be mentioned of the conflict of scientist with scientist. Among theologians also what battles royal there have been and how many

have yielded life rather than faith. Erasmus, Luther, Henry VIII, and Pope Leo X are one day all peacefully within the fold of one church, but on the morrow are each separately against all the others in the most terrific conflict.

Science and theology often unite in the same person, who thereby may be challenged on both sides. Copernicus was a theologian—an ecclesiastic. He was challenged by both scientists and theologians. So also was Galileo, who was also a theologian. Erasmus, whom White classes as one of the great champions on the side of science, was a theologian, and, while turning recreant mendicants on a spit before the world's ridicule, considered theology as the mother of sciences. Cotton Mather was a champion of vaccination against all the religous prejudice of his day, but lent himself to burning witches. Those who have combined scientific genius and religious faith would include nearly all the first rank scientists known to history.

It is a continual surprise that a man like Dr. White, who accepts evolution and can look with philosophic complacency upon the struggles for the survival of the fittest in the realms of biology, should so utterly fail to keep his poise in viewing the same conflict carried into the realm of thought. Shall physical organism be developed to stregnth by ceaseless struggle for place and the realm of thought be left a prey to any errant invader?

He who accepts evolution as the key to cosmic process thereby makes provision for this ceaseless conflict, or struggle, of opinion. If opinion at times arm itself with musket or fagot, the tragedy is no greater or more relentless than every day, since life began, is witnessed on land and in sea. Are not teeth, talons, and horns brought into use? War itself has been called "a bloody exchange of ideas."

An opinion is usually not opposed until it begins to make room for itself and dispossess men of that which they prize in property, position, or other vested interest. Self binders were burned in many a field by men thus deprived of a way to earn their bread. Said an eloquent man of the South, "The North had a splendid opportunity to develop conscience on the slavery question, having no money invested." The conflict came in attempting to dispossess men not only of their inherited opinions, but of their property as well. When Erasmus lampooned the mendicant monks, the Pope and princes joined in the laugh. But when the logical sequence brought forth Luther and his denunciation of indulgences, the opinions met papal denunciation. And when princes heard the growing murmur of the democratic spirit they too turned against the monk.

That which is prized most will be most jealously guarded, and

ardently defended,—thus a traitor to country is branded with infamy, and the violator of a home may be shot with impunity, for men have learned the value of country and of home, of virtue and sacred honor. It is in this ascending scale that we may look for an explanation of the resistless devotion to religious belief. The simple fact is that this belief embraces or affects all that men prize most in time and eternity. Even physical existence is lightly esteemed in comparison.

In tracing what he designates "the warfare of science with theology," Mr. White seems not to ask the meaning of what he everywhere takes for granted, viz., that science finds religious claim already covering every field that science enters. Crude indeed may be the interpretation in detail, but the field is possest. This leads to what I believe to be the key to human history. With Tyndall we consider it "a vast experimentation" in which aggregate humanity has been the investigator. The method has been true to human mind. The process has been "the continuous exercise of spiritual insight, and its incessant correction and realization." The hypothesis of this age-long experimentation must be adequate to the grand process. Transcending all the limited conceptions of physical process or human existence as held by puny individuals, we shall find the hypothesis by which the race of man is working out its destiny. We can trace it everywhere, not always in clear outline, but everywhere and always the race consciousness has apprehended some Being above man in whom is the final explanation of power and wisdom, of origin and destiny; whose thought is final truth, whose will is final authority, who himself is final cause.

Seers of old took the wings of the morning and gazed upon the glowing mist that signalled Creation's dawn. There, veiled in luminous glory, their keen vision discovered Him who inhabiteth Eternity. In the light of His countenance they caught the gleam of infinite purpose. At His breath moving nebulae began the cycle of starry worlds, and, in due time, of this earth upon which came grass and creeping things, and then Man, begotten in the image of the Infinite and summoned to share in the majestic process that holds in vision the progressive attainment of a civilization that shall ever more and more manifest the realization of the glorious humanity, that shall be clothed in the garments of praise and the beauty of righteousness, when love shall be law and human service the glory of all endeavor.

In this divine drama the student of today must learn well his part that he occasion no halting of the program. To this end he will require the data of science organized in the spirit and vision of religion.

The Needless Use of Verniers

Elwyn F. Chandler,

Professor of Civil Engineering, University of North Dakota

VERNIERS are devices attached to the scales of length or of angle on various classes of mesuring instruments for the purpose of reading the scales to smaller subdivisions than it is practicable to mark on the scale itself. A vernier consists of a short auxiliary scale of equal parts sliding along the main scale, the subdivisions of which are of such dimension that (in the usual patterns) there is one more division in the length of the vernier than in the same length of the main scale—or else one less; a glance along the vernier to determine which of its division-marks coincides most closely with a mark on the main scale determines the subdivision or fraction of a subdivision to be recorded.

Conditions are often such that, instead of determining the subdivisions of the smallest scale-unit by means of an attached vernier, it is convenient to make an estimate by eye of the fractional portion of a division to be recorded. The writer has arrived at the conclusion that the precision easily attainable by this method of estimate is much better than it has ordinarily been supposed to be. In order to form an opinion concerning the relative accuracy of eye-estimates of such fractions that may be expected from the average observer not habitually trained in this, the writer has secured from time to time the following series of estimates from about a hundred and twenty-five different persons the majority of whom were freshmen or sophomores in the engineering colleges of the University of North Dakota.

Twenty strips of cardboard of various lengths (from a few inches to about two feet) were placed on the wall at the opposite side of the room from the observer; a sharp, distinct ink-line had been drawn across each strip at some point in its length, these being well distributed at low, high, and intermediate points as would occur in any accidental distribution of fractional points; from the viewpoint of the observer, these strips could be considered to represent portions of a level-rod seen thru a telescope at distances of from one hundred to several hundred feet, and the ink-line was analogous to the cross-wire of the telescope seen crossing the rod.

Each observer then wrote down (with reasonable rapidity, as would be required in actual field-practise) a decimal estimate of the fraction of the whole length of each card cut off by the line across it. These decimal estimates were exprest by the observer as *hun-*

dredths of the whole length of each card, altho it was often difficult to persuade the observer that his figures could be anything better than a meaningless guess, for the average beginner is hardly able to believe that he can estimate to tenths, much less to hundredths. These estimates ultimately were compared with the precise mesured values, and the errors tabulated. The accompanying diagram conveys an idea of the general appearance of such objects; if the reader wishes to estimate these for himself, it may be noted here that by mesurement the fractional portion of A = .73 B = .22 C = .91 D = .31 E = .56 F = .82 G = .13 H = .68.

The total number of estimates obtained as above described was about twenty-five hundred. After comparison and tabulation, it was found that the probable error of a single estimate was two hundredths (0.020) of the whole observed length; that is to say, about half of the estimates were less than .020 in error, half of them more than .020 in error; this was the value secured from all the estimates turned in by all of the observers.

About one-sixth of the whole number of observers were persons who had had considerable previous training in this or similar work; their figures were separated from the results given by observers without special previous training, and found to have probable errors of less than .014 of the length observed. On the other hand, three of the observers were found to have been consistently unreliable, making errors so great that these observers seemed to be so abnormal or so careless that their entire sheets of estimates deserved to be thrown out. Likewise, because of lack of experience in such estimates, about half of the other observers were found to

have made one or two wild estimates among their twenty, and these single estimates were rejected; for it may fairly be assumed that after a little practise these wild estimates would not often occur. After these exclusions of the work of specially trained observers and of wildly erroneous estimates, the remaining estimates, a total of about two thousand, were used as a basis for most of the study and further deductions.

If any explanation is needed to justify this rejection of the few observations having absurdly large errors, it may be remarked that there is a difference in *kind* between inaccuracies (denominated "errors" in the theory of least squares) and blunders or mistakes. Inaccuracies are comparatively small, but mistakes may be of any dimension, so that large discrepancies must necessarily be due chiefly to unintentional mistakes, not to the unavoidable small inaccuracies arising from the imperfections of a method of mesurement. The question here investigated is the degree of precision possible for estimates by a careful observer, hence it is appropriate to reject blunders and mistakes, for any method of mesurement is subject to mistakes; indeed, as is afterwards explained, there is more danger of occasional large mistakes when using a vernier than with the eye-estimate method. Accordingly the two thousand estimates remaining after these exclusions were considered as fairly representative of the ability of the average careful observer after a brief training.

The criterion used for the rejection of estimates was Chauvenet's criterion, as presented in all works on least squares. By deduction from the usual or normal inaccuracy of results turned in by any observer this criterion sets an extreme figure above which any variation is properly assumed to indicate that the observer made a blunder requiring the rejection of that single observation; whereas below the extreme figure set by the criterion variations are assumed to be merely the result of the inaccuracies necessarily inherent in the instruments or system of mesurement or estimate used; by this criterion, the more accurate or the more consistent the work of an observer, the narrower the limits within which variation is allowed without subjecting the results to rejection. In the case of the untrained observers, about four per cent of their results were thus rejected for gross inaccuracy; in the case of the trained observers, despite the much closer limit set for them by the criterion, less than three per cent of their results were subject to rejection and even these were barely outside the limit, so that no very great errors would have entered if there had been no rejections; in other words, it was found that after a little training very large errors did not occur.

The probable error of the estimates now to be considered was computed and found to be slightly under .018; the total number of errors exceeding .05 of the whole length was counted and found to be less than six per cent of the whole number of estimates. At first thought it therefore appeared that such estimates would almost invariably give a correct result to the nearest tenth of a division, but it is seen that various other facts must be taken into consideration as follows.

If it were not desired to record a subdivision nearer than the nearest tenth, there would necessarily be an error attaching to most of the records even if the true value were known; for the true value would not ordinarily be precisely at a tenth and minor fractions of a tenth would be neglected; the error would always be between +.05 and ——.05, and the average error (which in this case is also the probable error) would be .025. In other words, if a vernier were provided for the purpose of subdividing a scale to tenths of a division, and if the vernier were always read truly without the slightest inaccuracy so as to give a true record to the nearest tenth of a division, yet the probable error resulting from the neglect of fractions of tenths would amount to .025; this is larger than the probable error of eye-estimates in the cases investigated, which is under .018.

If eye-estimates are made only to tenths of a division, the error of the estimates will necessarily be greater than above stated, for the neglect of decimals beyond tenths is likely to increase the error already inherent in the estimates. To determine the total error resulting from these two causes combined, the usual methods of the theory of least squares that were appropriate to this problem were applied, and the results were also checked by comparison with the actual numerical observations here investigated wherever it was not too laborious. The deduction was reached and verified that if an observer who is able by eye-estimate to subdivide to hundredths with a probable error of .018 makes records only to tenths, in the latter case his probable error will be .029; this shows that the error of his estimates is so much smaller than the error caused by the neglect of fractions of tenths that the first error is largely lost in the second error and is relatively unimportant. Similarly, if an observer able to estimate to hundredths with a probable error of .015 reads only to tenths, his total probable error will be less than .028; in other words, his error of estimate will be almost negligible when combined with the probable error of .025 that necessarily results from neglect of fractions of tenths.

If the probable error of a single estimate were .020 when reading to hundredths, and records were made only to tenths, it should be expected that a total error as great as or greater than an entire tenth will occur only about once in ninety times; if the probable error of a single estimate is .015, a total error when recording to tenths as great as one tenth will occur only about once in four hundred and fifty times.

It is now in order to inquire how often the reading to tenths made by eye-estimate will give precisely the same record as the true reading to the nearest tenth if by any means it were possible to secure such true reading. It is found that if exact values are distributed in every possible way at the incommensurable fractional points (as normally occurs in actual mesurements) and if as in this illustration the observer has a probable error of .018 when reading to hundredths but makes his record only to tenths which causes a total probable error of .029, then his record will in about seventy-nine per cent of the cases be at the tenth nearest to the true value, and in twenty-one per cent at a tenth not the nearest. But it should be remembered that this results in part because in many cases the true value is almost midway between two exact tenths, so that they are almost equally near, and a very small error may throw the record to the tenth that is not really the nearest tenth altho there is very little difference. Half of the time the true value is nearer to a tenth than to a half-tenth, and under such condition the observers investigated recorded the tenth truly nearest in ninety per cent of the cases; for the other half, when the true value is really nearer to a half-tenth than to a tenth, these observers record the nearest tenth in sixty-eight per cent of the cases, but under such condition the difference is small so that a vernier would often also be read to the tenth not truly the nearest.

In this respect the results of training were again plainly evident in the estimates made by those observers (about one-sixth of the entire number, and not included in the general averages) who had already had considerable practise in decimal estimates of one sort or another. Nearly every such observer had a probable error less than the errors of the inexperienced observers, and made no large errors or practically none. It seems a reasonable conclusion that with a little training almost any person not temperamentally incompetent to make accurate mesurements (such a person being inefficient and out of place as an operator for any type of mesuring instrument) can succeed in attaining a probable error not greater than about .015 in decimal estimates for the subdivision of any observed

length or unit such as investigated here. As above stated, an observer thus competent, if estimating to tenths, will make an error as great as an entire tenth only about once in four hundred and fifty times; eighty-two per cent of his estimates will be recorded at the tenth truly nearest; when the true value is nearer to a tenth than to a half-tenth, ninety-four per cent of his estimates will be recorded at the most nearly correct tenth.

The results here discust were all obtained from eye-estimates of the subdivisions of unit lengths of several inches to a foot or more, viewed across the width of a room. The writer has used several devices for testing the accuracy of estimates of subdivisions of small units (less than an inch or a few millimeters) viewed closely, and of still smaller units viewed thru a magnifier or microscope; altho he has not yet found it practicable to secure these from a sufficient number of different observers to warrant detailed publication, the comparative accuracy has usually seemed to be as good as in the series here discust. Under unfavorable conditions the probable error is somewhat larger, but seems likely in the worst cases to be not more than .020 to .025; the observations seem therefore to justify these general conclusions.

Careful attention is essential for reading a vernier correctly; it is needful to notice several division lines to determine which coincides most closely, and in many forms of instrument unless the scale is viewed from the proper angle parallax may vitiate the reading; the eye must examine the scale at several points, first to discover the principal reading, then along the various vernier lines to determine the subdivision.

If no vernier is used, the eye falls on the scale at but a single point, and at that same point estimates the fraction of the smallest unit division. After a little practise this can be done in much less time than is necessary for examining the principal line and subdivision lines of a vernier.

The multiplicity of lines on a vernier tends to confuse the eye, and sometimes occasions serious blunders, gross mistakes of several units; with the simplicity of a single scale, gross blunders are less likely, and the inaccuracies likely to occur are merely the small errors of eye estimates of subdivision. Hence (unless the vernier-readings are checked and verified by repetition of the readings) greater dependence may be placed on eye-estimates than on vernier-readings as regards their certain security against very large mistakes.

The untrained observer is likely to make gross mistakes with

any form of mesuring instrument; no reliance can be placed on his records until he is practised.

The trained observer will work with much greater rapidity and with greater security against large blunders if he is estimating subdivisions by eye than if he is using vernier, but the small errors of the estimates will necessarily be present in his records. If the smallest units of his scale are to be subdivided to tenths, the accuracy obtained by vernier will not be appreciably greater than that obtainable by eye-estimates; if the vernier is used to subdivide to twentieths and can be used correctly, as its average error from the neglect of smaller fractions is only .0125 the results from its use (if no other inaccuracies or disadvantages are in effect) will be somewhat more precise than if the subdivisions are estimated; if the vernier is used to divide to thirtieths or fortieths its results may be much better than estimates. In any of these cases, if the errors resulting from inaccuracy of eye-estimates are negligible in comparison with the other inaccuracies of the work, or are worth encountering by reason of the other advantages of the method, under many of the conditions in which it has been customary or conventional to use verniers such use is inefficient, needless, and wasteful of effort. Some of these cases will be itemized.

In field-work with surveying instruments it is the usual practise, when accurate levels are to be run, to use a level-rod divided to hundredths of a foot equipt with a vernier-target subdividing these to tenths (i.e. to thousands of a foot.) The setting of the target by the rodman and reading its vernier delays the work much, adds nothing to the accuracy of the result even at the best, and is likely to increase the errors by distracting the attention of the levelman and rodman from proper thought to the true verticality of the rod, adjustment of the level-bubble on the telescope-tube, permanence of turning points, and other essentials. Hence under all usual circumstances it is much more accurate (and also more rapid and economical of effort) for the instrument man to estimate the fractional subdivisions thru the telescope instead of signalling the rodman so as to set a vernier. The Coast & Geodetic Survey and some other surveys have in recent years adopted this practice for their precise-level work and have abandoned the use of vernier-targets except in special cases.

It is the writer's experience that in levelling this practise can advantageously be much extended, and that ordinary levels where readings to hundredths of a foot are to be recorded can under many circumstances be run more rapidly and accurately (if the levelman

has had proper training) by using a rod divided to tenths of a foot and estimating the hundredths; he has also run with satisfaction many miles of very rapid levels on reconnaissance by the use of a rod marked very distinctly and divided only to feet, which was read and recorded to tenths of feet by estimate.

Similar statements may be made concerning the forms of rod that are most convenient and rapid and sufficiently accurate that ought to be used for stadia work; but in this line the practise advocated by the writer is not so uncommon, and many topographers use rods whose smallest divisions are ten times as large as the smallest subdivisional readings that the instrumentman makes by estimate.

The ordinary surveyor's or engineer's transit has its circles divided to half-degrees, with verniers to subdivide these to thirtieths (that is, to minutes). On reconnaissance or other rapid work of such class that errors of one or two minutes will not be objectionable, speed may be gained with less danger of large mistakes if the vernier is disregarded and the minute merely estimated from the position of the zero-marker between the lines of the main scale. But if it is desired that the record should invariably give the nearest minute in the angle readings, a vernier is needed by most observers.

If as in some patterns the scale of a mercurial barometer is divided to tenths of an inch, a vernier is not needed for reading hundredths of an inch; however in such case it is useful to have a vernier attached, so that, if the observer occasionally becomes suspicious of the correctness of his own estimates, he may be able to reassure or correct himself by a glance at the vernier. In other patterns the main scale is divided to twentieths of an inch, with a vernier subdividing each into twenty-five parts, and if such accuracy is demanded a vernier is presumably advantageous.

Verniers are used on a great variety of shop instruments and drafting-room instruments, such as calipers and gages, clinometers, protractors, and planimeters, where the subdivisional readings made by the verniers are no smaller than eighths, tenths, twelfths, or fifteenths of the divisions of the main scale. In almost every such case the use of the vernier is needless, detracting from speed and in no wise adding to accuracy, if the observer has ordinary ability in estimating subdivisions by eye and has had a little practise in that line.

The writer wishes by this paper to call the attention of all using such mesuring instruments to the satisfactory degree of accuracy that they can probably secure without habitually using the verniers. In order to avoid the making of very large errors when beginning upon such custom, to determine how close an approximation

the estimates customarily reach, and to gain such self-assurance in estimates as will ensure speed, some means of checking estimates occasionally is desirable: for example, when an instrument having a vernier is in use and there is no need for haste, the subdivisions may be regularly read by estimate and recorded, and then immediately a comparison made between each and the vernier reading. Occasional practise of this nature will be found to consume little time, and to give a training which within a short time may be found to add much to the convenience of work and economy of effort.

The Connectivity of Surfaces

RAYMOND ROYCE HITCHCOCK,

Associate Professor of Mathematics, University of North Dakota

A SURFACE is said to be *connected* when from any point of it to any other point of it, a continuous line can be drawn without passing out of the surface. One of the simplest connected surfaces is the plane area enclosed and completely bounded by the circumference of a circle. All lines drawn in it from one internal point to another can be deformed by continuous variation in shape and length without departing from the interior of the region and any simple closed line lying entirely within the surface can be contracted into a point.

A *simply connected* surface is one in which every closed line forms by itself alone the complete boundary of a portion of the surface; a *multiply connected* surface is one in which every closed line does not possess this property.[1]

A multiply connected surface may often be made into one simply connected by means of *cross-cuts*. If the Riemann surface have a finite number of sheets and branch-points and if its boundary-lines form a finite line-system[2] it is always possible to modify it by these new boundary lines. A cross-cut is a line which begins at one point of a boundary, goes into the interior of the surface and without anywhere intersecting either another boundary line or itself ends at a point of the boundary. The four kinds of cross cuts may easily be recognized in the drawing, Fig. 1. *h i j k* is a cross-cut, because, as soon as it is begun, its points are immediately regarded as belonging to a newly added boundary. If a cut crosses a second cut, this first cut must be regarded as a combination of two cuts,, commencing at the intersection of the cuts. We might again define simply and multiply connected surfaces by saying that a surface is simply connected if it be resolved into two distinct pieces by every cross-cut; but if there be any cross-cut which does not resolve it into distinct pieces, the surface is multiply

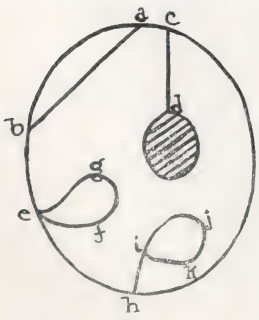


Fig. 1

1. Durege-Theory of Functions, p. 184.
2. Ibid p. 205.

connected. A spherical surface pricked thru with a pin is simply connected. A surface having a branch-point a at which n sheets of the surface are connected and bounded by a closed line making n circuits about a is *simply connected*. So, also, is a surface consisting of two sheets connected along a branch-cut between two branch-points a and b.

A plane ring is not a simply connected surface since a line from a point in one boundary to a point in the other does not divide the surface into two portions. If such a line is considered as a boundary, it makes the surface simply connected.

It is of great importance to be able to modify a multiply connected surface into one simply connected by adding certain boundary lines, impassable barriers. We shall classify surfaces according to the number of lines or cuts necessary to resolve the surface into one simply connected.

Consider the surface of an anchor ring with one hole. To provide it with a boundary we make first a pin-prick, P, Fig. 2. A closed line can be drawn from the pin-prick back to itself in two essentially distinct ways, $a\,b\,c$ *and* $a\,b'\,c'$ such that neither can be deformed so as to be evanescent or so as to pass continuously into the other. If $a\,b\,c$ be the only impassable barrier, a line such as $\alpha\beta\gamma$ cannot be deformed so as to disappear into a point; if $a\,b'\,c'$ be made the only impassable barrier the same holds of a line such as $\alpha\beta'\gamma'$. In order to make the surface simply connected two cuts such as $a\,b\,c$ and $a\,b'\,c'$ must be made. Such surfaces as the flat ring and the anchor ring are multiply connected surfaces.

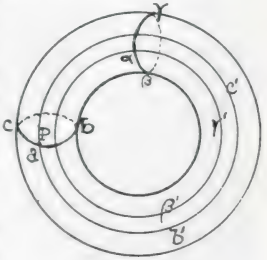


Fig. 2

We can state the following theorem:

If a resolution of a surface by m cross-cuts into n distinct simply connected pieces be possible, and also a different resolution of the same surface by μ cross-cuts into ν distinct simply connected pieces, then $m - n = \mu - \nu$.

From this it appears that if by any system of q cross-cuts a multiply connected surface be resolved into a number, p, of pieces, distinct from one another and all simply connected, the integer $q - p$ is independent of the particular system of the cross-cuts and of their configuration. The integer $q - p$ is essentially associated

with the character of the multiple connection of the surface and because of its invariance for a given surface we are enabled to arrange surfaces according to the value of the integer.

No cross-cut is necessary for the simply connected surface. Here $q = 0$, $p = 1$ and in general $q - p = -1$. We shall call $q - p + 2$ or unity the *connectivity* of such a surface. A surface is called *doubly connected* when, by one appropriate cross-cut, the surface is changed into a single surface of simple connection; then $q = 1$, $p = 1$ for this particular resolution, and, therefore, in general, $q - p = 0$. The connectivity is $2 = q - p + 2$. Examples of this surface are a plane ring and a spherical surface with two holes.

In general, a surface will be said to be N-*ply connected* or its connectivity will be denoted by N, if, by N—1 appropriate cross-cuts, it can be changed into a single surface that is simply connected. For this resolution $q = N - 1$, $p = 1$, and, therefore, in general,

$$q - p = N - 2 \quad \text{or} \quad N = q - p + 2.$$

The connectivity of a Riemann surface is determined by the following theorem:

"Let the total number of branch-points in a Riemann's n-sheeted surface be r; and let the number of branches of the function interchanging at the first point be m_1, the number interchanging at the second be m_2, and so on. Then the connectivity of the surface is

$$\Omega - 2N + 3$$

where

$$\Omega = m_1 + m_2 + \text{----------} + m_r - r."$$

Let us apply this formula to some of the surfaces studied[3] and find their connectivity. There is no trouble in finding the connectivity of the surface for

$$w = \left[\frac{z - a}{z - b}\right]^{1/3} + [z - c]^{1/2}$$

which is 3 and

$$w = \left[\frac{z - a}{z - b}\right]^{1/2} + \left[\frac{z - c}{z - d}\right]^{1/3}$$

which is 5. Look at the surface for

$$w = [z - a]^{1/2} + [x - b]^{1/2} + [z - c]^{1/2}.$$

Here the branch-cuts are from a to b and from c to ∞, and there are eight sheets. At both point a and point b we find four simple branch points, and at both point c and ∞ there are four simple branch points. Hence $r = 16$, $m_1 = m_2 = \text{------} = m_{16} = 2$. Then $\Omega = 16$ and the connectivity is $16 - 16 + 3 = 3$.

3. See "A Study of Riemann's Surfaces" in Quarterly Journal of the University of North Dakota, Vol. V., No. 1, October, 1914, pp. 32-42.

So far we have considered only cross-cuts and we ought to see how loop-cuts affect the connectivity of the surface in which they are made. A loop-cut is a line which comes back upon itself and lies entirely in the surface. A piece can be cut out of a bounded spherical surface by a loop-cut, but it does not necessarily give a separate piece when made in the surface of an anchor ring.

The effect of making a simple hole in a continuous part of a surface is to increase by unity the connectivity of the surface. It can be proved that the number of loop-cuts which can be made on a closed surface and still not resolve the surface into one simply connected is always the same for a given surface no matter in what order the loop-cuts are drawn. It is easier to classify a surface by this number of loop-cuts than by the number of cross-cuts which will change it into a simply connected surface. Let the number of loop-cuts which is the class of the surface be p. Then since the connectivity of a closed surface which has a point for a boundary is an odd integer, we may call the connectivity $2p + 1$ and we have the relation between the connectivity and the class expressed as

$$2p = \Omega - 2n + 2.$$

In applying the discussion on the connectivity of surfaces to Riemann's surfaces we shall now consider the Riemann's surface to be constructed over the sphere instead of over the z-plane.

Fig. 3

Let us consider a simple case, that of a two-fold sphere which is made up of two sheets connected by a single cut or bridge, Fig. 3. This cut or bridge we deform until it coincides with the arc of a great circle. The figures above show a section made at right angles to the bridge at its middle point a. Now reflect every point of the inner sheet upon the diametral plane containing the bridge. This is accomplished by cutting both sheets along the branch-cut., turning one sheet thru an angle of 180° while the other remains fixt and then fastening together the edges which were connected before. This

reflection does not alter the essential mode of connection. Figure B shows a section of the surface.

We can now pull the inner sphere thru the hole a (in Fig. B) and stretch it without tearing so that the resulting surface will be a one-sheeted sphere. Our Riemann's surface consequently has the same kind of connection as a sphere.

Now consider a case not so simple. Take a two-sheeted sphere with $p + 1$ bridges. Deform the surface without tearing until the bridges lie along one great circle. We shall cut both sheets along the branch cuts and make the same reflection as before, again fastening the edges which were connected before cutting. Where there was a branch-cut before there is now a hole at which the spherical surfaces pass continuously into one another. Now stretch one of the holes and flatten the two surfaces. What remains is a box-like surface having a single boundary and perforated with p holes.

This box with p holes can be deformed without tearing into a sphere with p handles. When $p = 0$ we have the ordinary sphere and when $p = 1$ we have the simple anchor ring. It is easy to see how the anchor ring with one hole can be deformed into a sphere with one handle. Keep a small part of the anchor ring fixt and inflate the rest until it approaches a spherical shape. This gives the sphere with one handle. We may consider the anchor ring as the normal surface.

A consideration of these surfaces brings us to a study of circuits. A circuit is a closed line drawn on the surface. Circuits may be classified as:

(a) *Reducible:* When they can be reduced to a point by continuous deformation without crossing a boundary; and

(b) *Irreducible:* When they cannot be so reduced.

The irreducible circuits are subdivided into three classes:

(a) *Simple:* When they cannot without crossing the boundary be deformed continuously into repetitions of one or more circuits;

(b) *Multiple:* When they cannot without crossing the boundary be deformed continuously into repetitions of a single circuit; and

(c) *Compound:* When they cannot without crossing the boundary be deformed continuously into combinations of different circuits that may be simple or multiple.

A compound circuit can be represented in terms of an appropriate system of $2p$ simple circuits, as a linear sum in which each coefficient indicates the number of times the simple circuit is repeated

in forming the compound circuit. Each coefficient is to be given a positive or negative sign according as the circuit which it multiplies is described in a positive or negative direction.

On a doubly connected surface one irreducible circuit can be drawn. (See Fig. 4.)

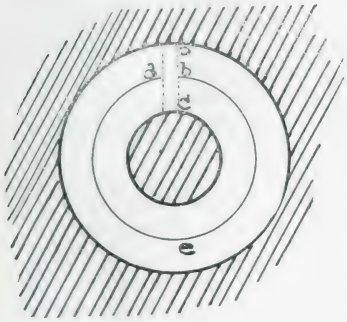


Fig. 4

On a triply connected surface two independent irreducible circuits can be drawn. (See Fig. 5.)

On a triply connected surface two simple irreducible circuits c_1 and c_2 can be drawn. (See Fig. 6.) Another irreducible circuit is c_3. This can be reconciled with c_1 and c_2 by drawing a into coincidence with the intersection of c_2 and c_1 and the point b into coincidence with the same point.

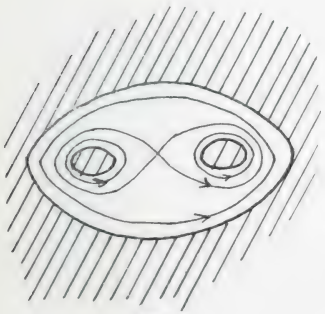


Fig. 5

Fig. 6

Let us see what irreducible circuits can be drawn on the surface for

$$w = \left[\frac{z - a}{z - b}\right]^{\frac{1}{2}} + \left[\frac{z - c}{z - d}\right]^{\frac{1}{3}}$$

This surface has two branch-cuts, $a\,b$ and $c\,d$ and can be deformed into a normal surface, a box with one hole and the number of irreducible circuits therefore is two.

For a surface having three branch-cuts the class is two and we can draw four irreducible circuits.

The Pseudo-Aurora

Bartholomew John Spence,

Assistant Professor of Physics, University of North Dakota

On the evenings of Friday and Saturday, January 15th and 16th, the inhabitants of Grand Forks and vicinity witnessed a most interesting spectacle in the pseudo-Aurora. Nearly every out of door light of high candle power had streaming above it a beam of light of unusual intensity, giving one the impression of the Aurora. In as much as the phenomenon was of considerable interest and since there has appeared some misunderstanding concerning the general nature and cause of the spectacle, a brief description of the phenomenon and its explanation has been thought not out of place.

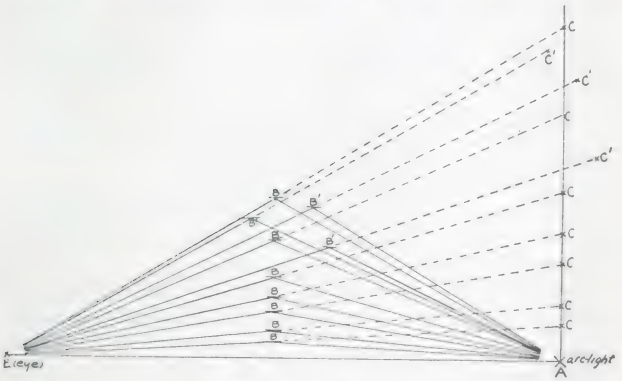
Before proceeding to an explanation it is necessary to enumerate carefully the observations which had a possible bearing upon the phenomenon on those particular evenings. The atmosphere on both evenings was laden with minute laminar crystals of ice, some of which were visible to the eye and others made their presence known by the gleam of light which they reflected. Thruout the first evening the atmosphere was very quiet; on the second evening there was blowing a wind of approximately seventeen miles per hour. The beam of light extending vertically above the source possest particularly sharp lateral edges: in some instances the beams while sharply defined laterally were not continuous but broken and of variable intensity, as tho a mist were moving slowly between the beam and the observer. The light beams were not observable as one approached to within roughly eight hundred feet of the light source. The light coming from the beams was furthermore largely polarized in such a way that the vibrations were parallel to the earth's surface. Finally perspective caused the various beams to appear to meet at the zenith. Other observations of importance might have been made, but unfortunately the proper apparatus was not on hand at those particular times.

Taking the observations as a whole, there appears as a process of elimination only one way to explain the phenomenon, namely on a basis of reflection, altho scattering regarded in its technical sense, diffraction, interference, etc., may play only a very unimportant role.

Proceeding on the basis of reflection, let A (diagram) represent an arc light sending a wave train to the thin lamina of ice B. Reflection will take place and the wave train will proceed to the eye E, when the ice crystal is properly oriented. As a result of reflection an image of the arc light will appear at C, as far behind the

reflecting surface as the arc-light is in front of it, and moreover the distance BC will equal AB. When the crystal surface is horizontal the image will be found in a vertical line directly above the arc light. There will be a great number of the crystals placed such that their surface is parallel to the earth's surface at different altitudes producing a large number of images in the vertical line directly above the arc, thus giving rise to the vertical beam of light.

Consider next crystals inclined at a small angle with the horizontal and perpendicular to the plane of the diagram. Let B′ represent such a crystal. It will have an image of the arc found in a manner precisely as the crystal discust above. It will not, however, be located in the vertical line above the light but in back or in front



Pseudo-Aurora

of it with reference to the observer, but in the plane of the paper. The eye cannot resolve the various images, and the focus is not sharp so that the beam of light will appear to possess no depth. Such crystals will not then change the appearance of the beam.

Suppose, however, that there are crystals inclined to the horizontal plane and to the plane of the paper. The images produced by these crystals will not be located in the plane of the paper. The result will be a fan-shaped distribution of illumination, contrary to observation. At this point it is necessary to introduce an assumption. It must be assumed that the particles in their flight deviate only slightly from their horizontal position. It is a well known observation that a body whose thickness is small compared to the other dimensions will fall in such a way that its position of greatest sta-

bility will be such that its largest surface is normal to the resultant force acting on it. We have all seen pieces of charred paper carried upward by convection currents and drifting off in the direction of the wind with an approximately uniform velocity and with their largest surface approximately horizontal. The ice crystals must behave in some such manner as this. That the wind plays no particularly important role, at least to within certain limits, is evident from the fact that on the second evening a brisk wind was blowing. The theory underlying the flight of a particle of the shape of the ice crystal demands that its behavior will be such as is assumed above and also that a wind carrying it along with an unfiorm velocity will not cause it to deviate materially from this position.

A further observation which apparently justifies the assumption is the fact that the light was polarized mostly in the plane of incidence. This is exactly what one would expect from insulating particles with a horizontal reflecting surface. With a sufficiently sensitive analyser there should be observed a maximum of polarization at an angle with the horizontal, corresponding to the Brewster angle, assuming the position of the crystal as horizontal.

If the ice particles behave as is demanded by the theory, that is, assume the horizontal position in their flight, then it is apparent from what was previously said, that the light will be seen only in a vertical column directly above the light.

Nothing has been said regarding multiple reflection, but on the assumption of a horizontal crystal position multiple reflection would not throw the light out of the vertical line. Scattering plays no role since there appeared no colored effects. Interference is no doubt present and would probably show its presence on examining the light from the beam with the spectroscope providing one could concentrate upon a sufficiently small area of large enough intensity.

Some Chemical Phenomena in Photography

FRED H. HEATH,

Assistant Professor of Chemistry, University of North Dakota

WE are frequently reminded of the physical and chemical effects produced by light. The bleaching action of light is a common thing, The fading of dyed fabrics, the color changes produced by light, the pleasant or unpleasant effects of certain colors, and the disagreeable results of sunburn are familiar experiences. We are constantly reminded of color sensation by all our surroundings and yet how seldom do we consider the nature of light or the nature of color.

Some of the effects of light are very evident to the senses and others are quite obscure. The velocity of light and the enormous distances thru which it travels are not often recalled. The physicist tells us that light is a vibratory wave motion and that its velocity of propagation is 186,000 miles per second. The astronomer tells us that the Pole star is so far away that its light requires seventy years to reach the earth always travelling at the same prodigious speed. The Pole star is one of our near neighbors; for there are some stars so distant that the light which is just reaching us now had begun its travels in the days when Egypt was a young nation.

After we realize what light can do it seems evident that it must be intimately associated with energy. This energy may be manifested in various ways. It may produce pressure, heat, physical change, or chemical change. The pressure of light can be easily demonstrated by a simple apparatus. The heating effects of sunlight are illustrated by the common condensing lens or burning glass. Under physical effects the change in color and crystal form of certain minerals are common manifestations. Changes in the electrical resistance of substances under the action of light are also common. In the case of the element selenium an application of this property is the basis of one form of a wireless telephone. A similar arrangement turns on some of the lights at the Panama Canal at sunset and turns them off at sunrise.

Some of the chemical effects of sunlight are not quite so apparent to our senses, while others are quite evident. A mixture of hydrogen and chlorine gases remains unchanged for years if kept in the dark. In diffused daylight the two gases gradually combine, while in direct sunlight they combine with explosive violence. Thousands of such photochemical changes have been studied and are now understood.

Under the action of sunlight and in the presence of the green chlorophyl of the leaf, the plant life around us utilizes the moisture in its cells and the carbon dioxide gas of the atmosphere for the formation of more plant material. At the same time the sunlight is the active agent in this chemical change, and the plant returns to the atmosphere oxygen for the use of man. Yellow light seems to be the most efficient in promoting this chemical change within the plant, and so far as we know at the present time other colors seem to be much less active. The older ideas of photochemical action a few years ago held that the longer waves of light shown in the spectrum were the source of heat energy and that it was only in the blue or ultraviolet regions that any chemical action was produced. We now know that this idea was incorrect. Light of any color may be able to produce a chemical change in a given substance, and it often happens that light of a different color will hinder or even reverse the former chemical change. Photochemical changes are of very common occurrence and great importance. In the last analysis agriculture is nothing but applied photochemistry, and many of the products that it furnishes to us can be prepared in the laboratory by chemical changes often assisted by the action of light. During the course of photochemical changes there is usually an evolution of heat, and oftentimes it is possible by the application of heat from outside to reverse the chemical effect brought about by the light.

The possibilities of photochemistry in the synthesis of valuable chemical compounds are enormous and it seems quite possible that the intense solar light and heat of the tropics may become of great commercial value. Ciamician, the great Italian photochemist, has predicted that in the near future the hot and arid desert regions of the earth will become scenes of great industries. He foresees great areas covered with apparatus in which under the action of the tropical sunlight man shall produce many of the important chemical products upon which he now depends.

A clear and sharp distinction should be made between photochemistry and photography. The former includes a study of all chemical changes that occur under the action of light. Photography includes only that very highly specialized branch of photochemistry made use of for copying or recording the images of various objects by the action of light.

Many people think that photography is concerned only with the chemical changes of compounds containing silver, but such is not the case. It is concerned also with the chemical changes produced by light in the salts of iron, platinum, gold, and chromium, and also

with the photochemical behavior of chlorine, bromine, iodine, carbon, and nitrogen in their compounds. The chemical properties of the substance known as gelatine are of very great importance in photography.

Practical photography is only about seventy-five years old, altho phenomena related to it were known in much earlier times. A study of the subject in relation to earlier discoveries and the more recent remarkable developments show that many men have contributed to our present achievements.

The earliest record of the formation of images by lenses and mirrors seems to be by Roger Bacon in the year 1267. In the sixteenth century it was noted by the alchemists that certain compounds of silver would darken in the light. In 1727, a German physician, John H. Schulze, discovered that he could "print" by the action of light on silver nitrate the form of dark objects. He put the latter on the surface of the silver salt and then exposed the whole to the action of light. In the year 1777, Scheele, the Swedish chemist, studied the action of light on silver chloride. He found that light decomposed it partially into silver and chlorine and that violet light was most active in causing this change.

One of the greatest difficulties in early photographic procedure was the inability of experimenters to render the darkened image permanent. To do this it was necessary to find some substance that would remove the portion of silver salt that had not been darkened by light and at the same time not affect the darkened image. Common salt was used for this purpose but it was not very satisfactory. In 1810 Sir John Herschel discovered a suitable solvent for the unaffected silver salt and he was able to render the image much more permanent. As a "fixing agent" Herschel used sodium thiosulphate, the salt known to photographers at the present time under the name of hypo. Of course, the image formed in this way was dark in the portions where the original object was light.

The next important step was made by Louis J. M. Daguerre, a French scene painter. He coated a copper plate with a thin layer of silver and then changed the latter into silver iodide or silver bromide. After exposure to light he found that the portions most affected by the light would attract mercury and build up an image when the exposed plate was treated with mercury vapor. In this case the plate was "fixed" by the use of hypo, and the result was an image in which the light and dark parts corresponded with the light and dark portrions of the original object. This picture was a negative, and for each picture produced a separate exposure was required of a

plate in the camera. Daguerre's process was patented in England in August, 1839, but was given free to the rest of the world.

The next advance was to put the sensitive silver salt on glass and to use some emulsifying agent to hold it in place. After exposure to light it was found that the "latent" image could be developed or rendered visible by treatment with other substances than mercury vapor. Such substances were called developers. By development this latent image was changed to metallic silver, and the image was then fixed as before by the use of hpyo. The substances used as developing agents were what the chemist now calls "reducing agents." Such substances have the power of changing a compound of a metal to the metal itself under certain conditions and then at the same time the reducing agent itself undergoes oxidation. This process is commonly called chemical development.

It was also found that an exposed plate could be developed in a somewhat different way. When it was put in a solution containing a silver salt and certain other chemicals the image would develop by the precipitation on the plate of silver from the solution. For some time this process was used under the name of "physical development." It was really a chemical process but it received its name from the fact that the image was built up from silver obtained from the solution and not from the plate. The process is no longer used as the present methods of chemical development give better results.

When it was found possible to obtain a good negative image on a glass plate it was only necessary to coat paper with an emulsion containing a silver salt and expose the paper under the negative and develop it in order to get a positive print of the original object.

The next improvements had to do with the substances used to hold the silver compound on the surface of the glass plate. The nature and the purity of this substance are of very great importance since they have a very marked effect on the sensitiveness of the plate and the convenience and successful working of the whole process.

At an early date egg albumen was used to hold the silver salt in place, but it fermented rather easily and possest other disadvantages. Collodion, a solution of gun cotton in ether, was next used. The collodion was mixed with a silver salt and coated on to the plate, and then the latter was sensitized by dipping it in a solution of potassium bromide in the dark room just before it was to be used. This treatment formed the silver bromide in the collodion layer on the glass plate. The plate was generally prepared by the photographer while his customer waited. The plate was put into the camera and exposed while still wet. This "wet collodion" process gave good

results but it was cumbersome and inconvenient. It is hardly possible to see how some of the war photographers of those days were able to secure any pictures of actual military operations. For some special purposes the wet collodion process is used even today.

The convenience and the extreme sensitiveness of the modern photographic plate are due to the use of gelatine as the emulsifying material. Gelatine is obtained from bones by boiling them in water after they have been previously boiled in acid to remove all mineral matter. Gelatine is used on practically all photographic plates and papers at the present time.

The modern methods of manufacture of photographic plates involve a great many carefully regulated manipulations, and the process requires well equipt and costly physical and chemical and optical laboratories. Many of the plate manufacturers also have departments for the manufacture of the sulphuric acid and nitric acid used in the process. They also have plants for the preparation of guncotton and other products needed.

The main features of the manufacture of plates may be summed up as follows: Silver is the starting point. This is made into silver nitrate by dissolving the silver bars in nitric acid. The silver nitrate is then crystallized and purified. The remainder of the operations must be carried out in weak red light as that color is the only one that will not fog the sensitive salt used on the plate. A solution of silver nitrate is treated with a solution of potassium bromide, or a solution containing a mixture of potassium bromide and potassium iodide. The solution also is warm and contains gelatine in sufficient amount so that when the mixture cools it will solidify. Someone has likened the appearance of the mixture to that of a rather thick soup. Under ordinary conditions potassium bromide will precipitate silver bromide in a curdy form and the latter will soon settle to the bottom of the containing vessel as lumps. However in the presence of the gelatine this does not occur, but the silver bromide remains indefinitely suspended as very fine particles which have a diameter of about 0.001 of a millimeter. The mixture is then cooled and allowed to solidify. The jelly-like mass is cut up in thin slices and thoroly washed and soaked in pure water. It is very necessary to remove all excess of potassium bromide and other soluble salts left in the emulsion, or the plate will not attain its maximum sensitiveness. Such a fine-grained emulsion is very slow, or in other words it is not very sensitive to light. Such slow emulsions are used only on lantern slide plates or slow plates for landscape work. For

rapid exposures in photography it is necessary to use a fast, or very sensitive, emulsion.

Some years ago it was discovered that if the photographic emulsion was kept hot for some time, or allowed to stand cold for a longer time, that the sensitiveness of the mixture toward light increased very much. This process was called "Ripening" of the emulsion. It is well known to chemists that if a liquid containing a precipitate is kept hot and is stirred, the grains of the precipitate become much coarser. This is an important principle made use of in chemical analysis. This sort of thing is exactly what happens to the silver salt during the ripening of the emulsion. The most favorable temperature for this ripening is about 32° Centigrade, or roughly 90° Farenheit. According to the speed of the plate desired the time of ripening may vary from a few minutes to several hours. The addition of ammonia or other substances which act as mild solvents for the silver bromide will promote the process of ripening. The ripening process must not be forced too far or the emulsion will fog on subsequent development just as if it had been exposed to light. It is also common knowledge to photographers that the fast, or coarse grained, plates do not keep so well as the slow, or fine grained, plates. The most sensitive condition of the emulsion is when the silver bromide shows a green color. At the stage when this occurs it has been found by mesurement under the microscope that the grains of silver bromide have a diameter of about 0.003 to 0.004 millimeter. After this ripening process the emulsion is coated evenly on to very clean glass plates, taking great care to have it evenly coated and also to avoid dust. Drying is done as quickly as possible, and then the plates are ready for packing and shipment.

Besides varying the size of the grains of the silver salt used in the plate emulsion there is another method of varying the sensitiveness of the plate. This is done by the choice of the kind of silver salt used in making the emulsion. Of the common salts of silver used in photography, silver bromide is the most sensitive to light. Silver chloride is still less sensitive, and silver iodide still less. Therefore by changing the proportions of these salts in the preparation of the emulsion the sensitiveness can be varied within quite wide limits. The character of the plate varies also in other ways. Silver iodide plates give very fine grained negatives of an unusual brilliancy. For each one of the silver salts used in the plate emulsion there is a certain definite color of light which will affect that salt most readily.

To the human eye yellow or greenish yellow is the color of greatest visual luminosity, but for the exposed and developed photo-

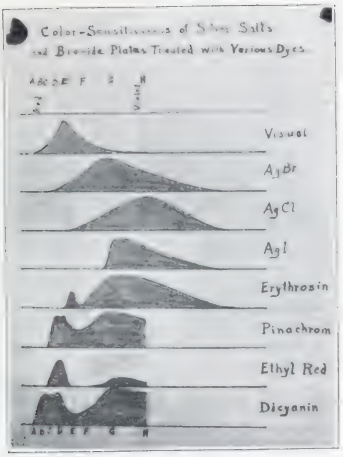


Fig. 1

Fig. 2. Photographed Immediately after taken on an Ordinary Plate without the use of the Color Screen.

Fig. 3. Photograph of Dandelions taken on a Color-sensitive Plate and with the use of a Color Screen.

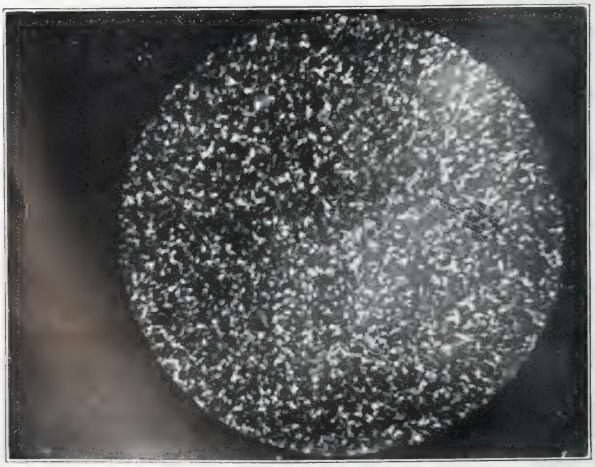


Fig. 4. Microphotograph of the Grains of Silver on a Negative Magnification 600 Diameters.

graphic plate the greatest density of silver deposit is not produced by yellow light. In other words the plate does not "see" an object in the same way that it appears to the eye. Therefore the picture does not appear natural.

Let us consider these effects keeping in mind the band of colors of the solar spectrum. In Figure 1, the effects are plotted to scale using the letters A to H to indicate the common notations of wave lengths as mapped in the spectrum charts. A represents the limit of visibility at the red end of the spectrum, and H is the extreme limit of visibility in the violet end of the spectrum. The invisible infra red and the heat wave radiations come to the left of A, and the very short wave lengths of the invisible ultraviolet are to the right of H. The extremely short radiations known as the X-Ray are still further to the right. Between D and E the crest of the first curve shows the maximum visual luminosity in the yellow. D represents the yellow line for monochromatic sodium light. The sensitiveness of silver bromide, AgBr, is shown in the second curve. It begins in the orange yellow, reaches its maximum at G in the indigo blue, and its sensitiveness extends beyond H out into the ultraviolet. This ultraviolet light is invisible to the eye and does not pass thru a glass lens, so that it does not have much effect in ordinary photography. By the use of lenses made of quartz, photographs may be taken by ultraviolet light. Important applications of this are in use.

The next curve shows the sensitiveness of silver chloride, AgCl. It will be noted that its sensitiveness begins at E in the yellowish green of the spectrum, reaches its maximum just beyond H in the ultraviolet, and extends out into the ultraviolet.

The next curve is for silver iodide and it is rather peculiar. The sensitiveness of this salt begins in the indigo blue near G, quickly reaches a miximum and extends out into the ultraviolet. Plates coated with silver iodide are sensitive to blue light, but they are insensitive to green, yellow, orange, and red. Such plates may be safely developed in weak daylight. This behavior has applications in practical photography.

From the above considerations in regard to the first four curves of Figure 1 it is evident that the visual appearance of colored objects will vary considerably from the recorded image on the developed plate. This leads to the use of special methods and materials for the correct rendering of color values on a plate.

It is a principle of photochemistry that when light falls on a substance it is only that portion of the light absorbed by the sub-

stance which produces any chemical changes. Now if we can cause a plate emulsion to absorb the red, yellow, and green wave lengths of light more readily than it naturally does, then there will be a better rendering of those colors on the plate. An emulsion containing any one or all three of the silver salts does not render yellows and reds. By adding to the emulsion a very minute trace of certain dyes the plate is made to record the action of red, yellow, and green. The last four curves shown in Figure 1 show the sensitiveness of silver bromide plates stained with the dyes whose names are given opposite each curve. Evidently plates may be made to record color values with approximation to the visual luminosity. Such plates are known as "Othochromatic," "Isochromatic," or "Panchromatic."

The number of dyes available for the making of such plates is considerable, and by a proper mixture of dyes almost any part of the spectrum may be recorded photographically. The amount of dye used is exceedingly small. It may be added to the emulsion when the plate is coated, or a finished plate may be sensitized by soaking it for a short time in a very weak solution of the dye and then drying it in the dark. More rapid absorption of the dye is favored by the presence of a little ammonia in the solution. There is strong evidence to indicate that the dye is not simply mixed with the emulsion but that there is also a certain amount of chemical action between the dye itself and the grains of silver salt in the emulsion.

Up to the present time it has not been found possible or practical to sensitize a plate for all parts of the spectrum, and so we make use of a color screen, or "Ray Filter." This latter object consists of a cap which fits the lens of the camera, and this cap carries a piece of gelatine or celluloid which has been stained with a small amount of a dye similar to the dyes used on the color sensitive plates. By the use of this screen the time of exposure is lengthened somewhat because the screen cuts down the intensity of the light which enters the camera, but it gives a more perfect rendering of color values.

Figure 2 shows a picture of some dandelions in full blossom. This picture was taken on a plate that had not been sensitized with dyes, and without a color screen.

Without moving the camera the picture shown in Figure 3 was taken. This picture was taken on an orthochromatic plate and with the use of a color screen. The difference in the two pictures is apparent at once. Without the color screen the yellow dandelion blossoms appear at patches of clear white. With the color screen the yellow blossoms show the detail of their different colored parts.

There will be noted also a difference in the color rendering of the green of the leaves and the grass on comparing the two pictures. The beautiful rendering of clouds in landscape photography is done by the use of color sensitive plates and color screens. This branch of photography has many important applications in microphotography, in legal work, in portraiture, and in science.

Very recently the color sensitizing of photographic plates and papers has been carried still further. It has been found possible to choose the dyes so that the emulsion shall be sensitive to the ultraviolet invisible wave lengths, and practically insensitive to visible light. A similar thing has also been accomplished for the infra red waves.

Some of the most striking applications of ultraviolet photography are in the detection of forged signatures on documents, and in tracing faint markings on ancient manuscripts. The same principles have lately found important uses in astronomical photography.

We have considered the sensitiveness of the photographic emulsion as it is affected by the size of the grains of the silver salt used by the choice of the silver halide used, and also as affected by the dyes present in the emulsion. Altho these matters have been discust, we have not found what happens to the silver salt itself when it is exposed to light.

During the action of light on a photographic emulsion a chemical change occurs, and as a result of this change a "latent image" is formed. In all ordinary cases so far as the eye can detect there is no visible change on the plate, and yet it can be "developed" or put thru a chemical treatment which gives an image in metallic silver. Figure 4 shows a microphotograph of a small section of a developed plate. The magnification used on the microscope was about 600 diameters. The grains of silver are easily seen against the background of clear glass.

There have been many theories to account for the facts observed in connection with the behavior of the latent image. The most important of these are two in number: the Sub-halide Theory, and the Colloidal Silver Theory. A thoro discussion of these two theories with all the related facts would fill several books. However we will attempt a brief consideration of the more prominent points.

The Sub-halide Theory. Silver bromide has the chemical formula, AgBr. This formula means that it consists of one atom of silver and one atom of bromine. The sub-halide theory assumes that light decomposes silver bromide into silver sub bromide, according

to the following chemical equation: $2AgBr = Ag_2Br + Br$. It is held that only a portion of the salt on the plate undergoes this chemical change. According to the above chemical equation free bromine is a product of the chemical action, and the sub bromide formed contains only half as much bromine for the same weight of silver as there was in the original substance. More recent investigations render this hypothesis very doubtful. By long exposure to light it is not found possible to cause pure silver bromide to lose as great a weight of bromine as would be called for by the above chemical equation. Furthermore, the product formed by the action of light on silver bromide is found always to contain a small amount of very finely divided metallic silver. The sub-halide theory does not account for this fact. While only a very small part of the total quantity of silver bromide on the plate is chemically changed on exposure to light, yet when the plate is developed a fairly large quantity of metallic silver is deposited on the plate. The portions of the plate acted upon by light seem to act as nuclei for the deposition of silver during the process of development.

The Colloidal Silver Theory. Now let us consider the other theory as to the constitution of the latent image. It was mentioned above that the latent image always contains metallic silver, but the most careful chemical analyses and painstaking investigations have never been able to show that exposed silver bromide contains any silver sub bromide.

From the behavior of the daguerreotype plate we have still further evidence in support of the colloidal silver theory. Colloidal silver means very finely divided metallic silver. The exposed parts of a daguerreotype plate will retain metallic mercury, while the unexposed portions do not have this power. Now it is a well known fact that metallic mercury will attract silver, copper, lead, and many other metals and form with them alloys or amalgams. So if the latent image contains metallic silver the action of the daguerreotype plate can be easily explained. The sub-halide theory can not account for this action.

The whole problem of the latent image is very complicated because the amount of decomposition caused by light is so very small and also because the presence of gelatine complicates the study of the chemical action of the silver salt itself.

Certain peculiar physical effects are also produced when a plate is exposed. By long exposure the color of silver bromide changes, and it shows the same series of colors that are noted with colloidal silver when prepared by chemical methods and exposed to light. When

a plate is exposed to light there is also a certain amount of mechanical disintegration of the grains of silver bromide. Another effect is the slow decay of the latent image with time. This is favored by certain conditions of humidity, etc. If an exposed emulsion is put in contact with an unexposed emulsion, after a time it is found that by development of the second emulsion an image of silver will result. In other words the latent image printed across from one plate to the other.

In the exposure of a plate the amount of chemical change produced is supposed to depend upon the working of the Bunsen Roscoe law of photochemical action. This law states that the degree of chemical action produced depends upon the product of the intensity of the light and the time during which it acts. This law seems to hold for plates.

There are two time limits in the exposure of the ordinary plate. An exposure may be so short as to produce no visible image after the plate has been developed, or it may be so long that a still longer exposure will give no increase in the density of the silver deposited on the plate after development. An exceedingly short exposure, which is too short to produce any image, actually renders the plate more sensitive when it is finally given a proper exposure. This fact is applied in astronomical work. When a developed plate shows the same degree of gradation between lights and shadows as existed in the original object it may be considered that the exposure was correct. Such a plate will give good prints. By giving a plate a very long exposure the chemical action on the emulsion is of such a nature that when the plate is developed a positive is the result and not a negative. The lights and shadows of the plate correspond to those of the original object. Such action of a plate is known as "Reversal," or "Solarization." This effect is not well understood, but certain physical conditions and the chemical composition of the plate emulsion have marked tendencies to cause it or to prevent its occurrence. It is made use of commercially to some extent.

Figure 5 shows the exposure curve for a plate. The density of the silver deposit obtained by development after various exposures have been given is plotted against the logarithm of the time of exposure. For all kinds of plates this curve has the same general shape, but the relative length of any given portion of the curve may vary somewhat. The different parts of the curve are lettered and they are described below according to this scheme of lettering.

The portion A shows the condition of under exposure. From the shape of the curve it is evident that the density of the silver de-

posit is increasing more rapidly than the time of exposure. An under exposed plate is slow in starting development when treated with the developing solution. The finished negative is thin and lacking in density of silver deposit and it requires a somewhat different procedure in the making of prints. On such a plate the contrast between lights and shadows is exaggerated. The portion B of the curve show the region of correct exposure. With most plates there is a fair amount of latitude in the time of exposure. Slow plates generally have a greater latitude of exposure than fast plates, and the latitude of exposure increases with thickness of the emulsion on the plate.

The portion C of the curve shows the region of over exposure. It will be noted from the shape of the curve that the density of the silver deposit obtained by development grows slowly as the time of

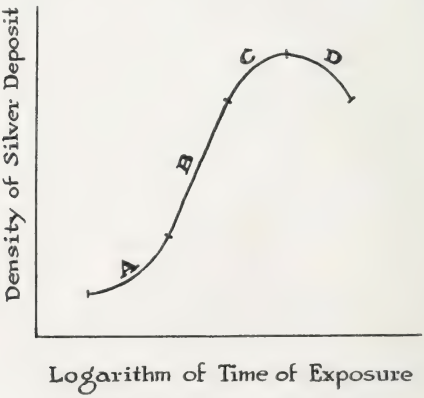


Fig. 5. Exposure Curve of a Photographic Plate.

exposure increases. Such a plate quickly blackens in the developing bath and the finished negative is dense and flat. It requires long exposure in the making of prints and the latter are likely to be flat and lacking in detail and brilliancy. An over exposed plate shows poor detail in the shadows. The portion D of the curve shows the condition of solarization, or reversal. If this effect goes far enough a positive is produced.

We have considered what the photographic plate is, and how it acts on exposure and development, and now it remains for us to discuss briefly the chemical action of the developing solution itself.

The essential constituents of a developing solution are as follows:

1. *A solvent.* Water is always used to dissolve the chemicals employed.

2. *A developing agent.* This is usually a very complex organic chemical compound. It is a substance that is capable of rather easy oxidation, and it can reduce the latent image to metallic silver. Most of the developing agents are derived from coal tar compounds.

3. *A preservative.* Unless such a substance is present in the solution the developing agent is soon oxidized by the oxygen of the air and the developing action is soon impossible.

4. *An accelerator.* Water penetrates the pores of the gelatine emulsion very slowly, but if an alkaline substance is present this action is much more rapid. Sodium carbonate, or sometimes sodium hydroxide, is used for this purpose.

5. *A restrainer.* In case the developing action is too rapid we can control it more readily by adding potassium bromide, or citric acid, to the developing solution. This allows the full development of fine details of the image.

Any thing like a thoro discussion of the action of developers is a whole subject in itself. A thoro understanding of it requires a detailed knowledge of chemistry, and further consideration of it is beyond the scope of this article.

In this article on chemical action in photographic work an attempt has been made to outline some of the main features of the processes involved. Photography now has an important place in the scientific world, and it furnishes an accurate record of events, such as the historian cannot describe fully by his pen. An industry which uses one-seventh of the silver production of the United States is certainly worthy of consideration.

Book Reviews

THE ELECTRON THEORY OF MATTER: O. W. RICHARDSON, Wheatstone Professor of Physics at King's College, London. Cambridge University Press and G. P. Putnam's Sons, New York, 1914. VIII + 612 pp. Price $4.50.

The Electron Theory of Matter by Professor O. W. Richardson is the latest book issued by the Cambridge Press in the Cambridge Physical Series. It is based on a series of lectures delivered to graduate students at Princeton University and is intended "to exhibit the extent to which the fundamental facts of physical science may be coordinated by means of the conception of the electron and the laws of electrodynamics." There seems to be something essentially appealing in an atomic theory of matter or electricity and from the earliest times it has been suggested that in some such theory lay the explanation of chemical and electrical phenomena, but it is only during the past decade that an electron theory of matter has been developed in any really adequate way. Professor Richardson's book is a comprehensive and, with one or two exceptions, an up-to-date presentation of this subject.

The first eight chapters of the book are devoted to the fundamentals of electricity and magnetism and the classical electrodynamics. Chapter IX starts with the fundamental equations of the electron theory and the assumption "that matter is *nothing but* a distribution of electrified elements of volume in space." There then follow chapters on Charged System in Uniform Motion, Charge Moving with Variable Velocity, The Ether, The Principle of Relativity, Radiation and Temperature, Theory of Magnetism, Kinetic Theory of Electronic Conduction, Equilibrium, Theory of Electronic Conductors, Types of Radiation, Spectroscopic Phenomena, The Structure of the Atom, and Gravitation. Nearly all of the subjects are receiving the concentrated attention of both the theoretical and the experimental physicists and are still in a state of flux. The current literature on them is necessarily highly specialized, so that a book which brings each subject up to date and correlates them all into a consistent whole is of great value to anyone who has not been able to follow the detailed development of each subject. In the case of doubtful or disputed points the author has presented both sides in a clear manner and pointed out in many cases the need of further work.

The mechanical features of the book are characterized by the excellent qualities always associated with the books in this series.

E. B. STEPHENSON

Department of Physics,
University of North Dakota

THE TEACHING OF MATHEMATICS IN THE ELEMENTARY AND THE SECONDARY SCHOOL: J. W. A. YOUNG, Associate Professor of the Pedagogy of Mathematics, University of Chicago. American Teachers Series. New Edition. Longmans, Green, and Company, New York, 1914. XVIII + 359 pp. Price, $1.50.

In this book Dr. Young has given a great inspiration not only to the prospective teacher of mathematics but also to the one whose experience has shown most clearly the existence of problems of teaching. There is not given a great deal of the historical, nor are many topics of subject matter dealt with, yet the work is concrete in its illustrations—and gives the teacher an ample opportunity to develop along correct pedagogic lines. The bibliographies preceding each chapter are quite remarkable in their completeness.

The first chapter treats of the study of the pedagogy of mathematics. I would that it were more generally the belief that a mere knowledge of their subject matter is not a sufficient preparation for the teacher. There is, however, a growing appreciation of the fact that mathematics is probably the most difficult of all subjects to teach, and could the importance of this subject in the primary and secondary schools be realized we should soon find that the teacher who has specialized in some other subjects would not be required to teach mathematics. In any university where mathematics is an elective a large percentage of the students can not be persuaded to take up any branch of it, and the reason goes back in nearly every case to the poor teaching done in the high schools and grades. Dr. Young claims that there does not exist the normal mind which can not learn mathematics. People who say they have "no head for mathematics" and yet who succeed more or less in other subjects have been cheated of their heritage by poor teaching. The value of the study of mathematics is discust under several heads and it is shown that for direct practical usefulness, mathematics is second only to the mother tongue; that it is one of the few characteristic types of human thought which no civilization has ever failed to evolve and with essentially the same results; that the phenomena of nature can not be understood without it; and that it exemplifies

especially well certain important modes of thought as understanding statements, noting facts, and making inferences.

Chapter III deals with methods and modes and is one of the most useful sections of the book. In this discussion method is defined as the manner in which the subject matter is arranged and developed and mode as the manner in which it is presented to pupils. The synthetic, analytic, deductive, inductive, Socratic, heuristic, and laboratory methods are described as to function and the modes are the examination, recitation, lecture, genetic, heuristic, individual, and laboratory. "The test of every mode," says Dr. Young, " is whether or not it is, at the time it is employed, the mode which enables the teacher to give to the class, to every pupil, the most of himself, of his knowledge, of his experience, of his guidance, of his enthusiasm, of his inspiration."

In the next three chapters a somewhat fuller discussion is made of the heuristic, individual, and laboratory methods—their values, dangers, disadvantages, needs, and essential ends. These pages are full of the most sound pedagogy and the teacher is made to realize that there is good as well as bad in each method and only an intimate knowledge of the individual needs of the class coupled with sound judgment can determine the method to be used.

A splendid chapter tells of the preparation of teachers and of a means to keep teachers growing. Too many are content to rest with a knowledge only of the subjects they are required to teach and have not the broad viewpoint acquired by the study of more advanced subjects and continual reading. To this end there is added a list of available English and foreign books, which should be accessible to every teacher of mathematics,—a list of magazines, and a splendid list of subjects for club discussion.

In the chapter on the Curriculum in Mathematics, Dr. Young urges the simultaneous teaching of algebra and geometry—an action which can be taken by the single progressive school without interference in its relations with colleges and technical schools. By the correlations of these two subjects and also of higher algebra and solid geometry in the later years in high school the pupil will have a deeper and clearer insight into elementary mathematics. The old order seems to be traditional and failure to make the improvement is due to inerita and conservatism.

The last four chapters of the book take up the teaching of arithmetic, geometry, and algebra. So much of value is given in these chapters that grade and high school teachers can well afford to read these pages as a matter of daily preparation. I have not space

here to discuss the various topics under each subject—but let it be said that the conclusions are given after a long experience in teaching and observation in elementary and high schools. The subjects to be included—those to be omitted, the method of procedure, definitions, correlations are all based on results of experience and are not stated dogmatically.

RAYMOND R. HITCHCOCK

Department of Mathematics,
University of North Dakota

THE SPECTROSCOPY OF THE EXTREME ULTRA-VIOLET: THEODORE LYMAN, Assistant Professor of Physics, Harvard University. Longmans, Green and Co., New York, 1914. V + 134 pp.

In the literature on the spectroscopy of the ultra-violet, the work of two men seems to be preeminent, that of V. Shumann and that of Lyman. It is therefore appropriate that an account of the fertile but experimentally difficult field of spectroscopy be rendered by one of these men.

The book on The Spectroscopy of the Extreme Ultra-violet by Professor Lyman is divided into two parts. The first part, consisting of twenty-nine pages, deals with the photometry and absorption of gases and liquids in the ultra-violet spectrum. The second part consisting of five chapters contains a description of the apparatus used in this field of spectroscopy and especially of Lyman's grating spectroscope especially designed for the work. The remaining chapters are devoted to a study of the absorption of solids and gases, the emission spectra of solids and photo-electric and photo-abiotic phenomena.

In reading the book one is impress with the remarkable work of Shumann, which covers an immense field and with the remarkable precision of observation attained in his researches. Much of the work of Lyman detailed in the book is in repetition and corroboration of the work of Shumann with the grating spectroscope. While the work of Lyman has been that of corroboration, he has also extended it in various directions, undertaking the study of absorption and emission of many new substances and extending the limit of the ultra-violet spectrum. As the situation now stands, the extreme limit of the ultra-violet spectrum has been pushed to about 900 Angstrom units by spectroscopic methods. Other evidence points to a limit of about 750 units, a result which however needs corrobora-

tion. It is interesting to see the gap shortening between the ultra-violet radiation and X ray radiation.

One is impress with the difficulties of experimental procedure overcome by patient and laborious work. The book is a resume of the spectroscopy of the ultra-fiolet and places the salient features of the subject at one's immediate command.

B. J. Spence

Department of Physics,
University of North Dakota

A Course in General Chemistry: William McPherson, Director of the Chemical Laboratory, and William E. Henderson, Professor of Inorganic and Physical Chemistry, Ohio State University. Ginn and Company, Boston, 1913. VIII + 556 pp. Price, $2.25.

The title of this volume conveys the comfortable impression that it is designed expressly for the use of students, and it is pleasant to find after careful examination that the well-known authors have consistently kept faith with the beginner in chemistry. In a science so diversified and comprehensive as chemistry, it is only natural that teachers should differ in their ideas as to the nature and content of the introductory course and that these different viewpoints should be reflected in the extreme types of chemistry text books now bidding for favor in schools and colleges. Many teachers, especially those trained in recent years, are inclined to make the elementary course largely an introduction to the study of physical chemistry while others, in disgust, roundly denounce this tendency and advocate the presentation of the descriptive facts and their applications in the industries. Thus there has arisen a spirited controversy out of which we may hope to see gradually emerging a more rational compromise nearer the ideal in its symmetry and balance. The present volume appears to be a contribution in this direction; for the authors have combined their experience and efforts in a joint authorship which freely introduces modern ideas while still retaining the descriptive matter of the older chemistry. Nor does this imply a lack of unity in the treatment; on the contrary greater unity is realized in the plan of utilizing theories and principles as vital aids to the student's understanding and interpretation of chemical phenomena.

In their preface the authors state that "the treatment of theory in any text will always leave many teachers dissatisfied," and that they have merely followed their own method. They have not hesi-

tated to introduce fundamental theories whenevr such devices appeared really to assist students in their understanding of chemical processes avoiding, however, "partisan feeling for any particular theory," and seeking always "to impress the student with the idea that theories are largely a matter of convenience and are not to be regarded as "final." It is really refreshing to find a text in which the Atomic Theory is introduced without a squeamish apology.

In general this text follows the conventional historico-systematic presentation with "few novelties either in arrangement or method." "In the main the elements have been grouped in accordance with their positions in the periodic classification, but the authors have not hesitated to abandon this order when a more natural one suggested itself."

Perhaps the most conspicuous novelty is the postponement of the halogens until Chapter XIX—a departure from the conventional treatment which appears justifiable on account of inherent difficulties in manipulation and interpretation which these elements present. It is also unusual to find the discussion of Gay Lussac's law of combining gas volumes and Avodadro's hypothesis deferred until Chapter XII in which the methods of determining molecular and atomic weights are systematically treated. In the opinion of the reviewer the gain in this systematic treatment is largely offset by the loss to the student in his earlier appreciation of the nature of gases and the kinetic theory.

Many teachers of elementary chemistry will doubt the wisdom of using the algebraic treatment of the law of combining weights on page 86, and criticize the treatment of the law of mass action and chemical equilibria, especially the quantitative application of the laws to the case of strong electrolytes, notwithstanding the statement in a later paragraph that "in all such cases, as for example with nitric acid, the equations just explained will not apply with accuracy over any considerable range of concentration, and exact calculations cannot be based upon them." As a matter of fact is it not true that in moderately concentrated solution the strong electrolytes do not even approximately follow the law of mass action? If the quantitative formulation seems at all advisable would it not be better to introduce the equation of Kraus and Bray wherein a second term is added to the mass of action constant expressing the influence of the total ion concentration on the equilibrium, and then to point out that this term, D(Ci)m, becomes negligibly small in comparison with the mass action constant, K, in extremely dilute solution in which condition even strong electrolytes then follow the mass action law? On the

whole it would appear to be better to treat the subject from the qualitative viewpoint, basing the study of chemical equilibrium on the broad principles of Van't Hoff and LeChatelier.

It would seem that the ionic theory might have been used to greater advantage in the explanation of oxidation and reduction in the case of manganese, chromium, etc., and in some other instances. The space devoted to the chemistry of carbon appears to be in good proportion, and it is pleasant to find that by conserving space a more extensive description of the "rarer" elements is permitted than is usual in elementary texts. The authors deserve special credit for their efforts to "make statements concerning industrial processes accord with present usage." In this they have enjoyed the cooperation of many managers of industrial plants as well as the advice of their colleagues. Minor errors are very few, and they will no doubt be entirely eliminated in future editions.

Finally it may be added that the criticisms here suggested are intended to be entirely sympathetic and constructive. On the whole the authors have done their work remarkably well, and they are to be congratulated on their success in producing a thoroly teachable text-book, modern in spirit and treatment, interesting and conservative. Already it is enjoying a wide and deserved popularity, and it will doubtless continue in favor with teachers who appreciate its poise and symmetry.

G. A. Abbott

Department of Chemistry,
University of North Dakota

Principles of Quantitative Analysis. An Introductory Course: Walter C. Blasdale, Associate Professor of Chemistry, University of California. D. Van Nostrand and Company, New York, 1914. 394 pp. Price, $2.50.

For some time it has been a problem to decide upon the most suitable text-book for an elementary course in quantitative chemical analysis. Many of the available books were too lengthy. Others gave directions for the laboratory procedure and did not give any theory of the process, or any reasons why a certain procedure was to be followed. Analysis by such a method might justly be called "cook-book chemistry."

The new book by Blasdale seems to be very readable and concise, and at the same time it is scientific in its spirit. The book includes a good choice of subject matter and the processes oultined

cover a suitable range of typical and important chemical analyses. Students have remarked upon the clear and pleasing style of the text.

The analytical methods discust in the book are arranged under the following ten sections:

1.	General Features of Gravimetric Processes	77 pages
2.	Gravimetric Gas-Evolution Processes	33 "
3.	Gravimetric Precipitation Processes	84 "
4.	Gravimetric Solution and Extraction Processes	21 "
5.	Partition Processes	14 "
6.	General Features of Volumetric Processes	22 "
7.	Volumetric Processes Involving Precipitation	21 "
8.	Volumetric Processes Involving Neutralization	33 "
9.	Volumetric Processes Involving Oxidation	44 "
10.	Physico-Chemical Processes	31 "

In the earlier sections of the book the author takes up the discussion of many important physical facts which are closely related to quantitative analysis. He gives a very clear description of the sampling of ores and commercial products previous to the chemical analysis, and gives a good idea of how electric furnaces and ovens are now used in the chemical laboratory. The discussion of the theories concerned in exact chemical work is very good. A clear description or even mention of such things is often lacking in the usual text on quantitative analysis. Much of the discussion assumes that the student has had a good preparation in physics and that he has taken considerable work in chemistry. While this feature of the book might be condemned by some who use it as a text, it would seem reasonable provided the student has been taught his preparatory courses in chemistry from the modern view-point and by a well-trained teacher. Some of the problems in the book may be rather difficult for the student. The attempt of the author to require some thinking on the part of the student is commendable. Furthermore the close attention to experimental details is truly scientific and it should produce accurate results in the chemical analysis.

One rather objectionable feature of the book is the demand for the beginning student in this subject to use apparatus which is quite costly and so elaborate that he might be likely to break it. Another unpleasant feature is the large number of errata. It is to be hoped that this matter will soon be remedied.

The references to original articles in the chemical literature, the questions and problems, and the convenient size of page and

clear type all tend to render the book very attractive. In its use as a text in the department of Chemistry this year the book seems very satisfactory.

FRED H. HEATH

Department of Chemistry,
University of North Dakota

A SPRING FLORA FOR HIGH SCHOOLS: HENRY CHANDLER COWLES, Associate Professor of Plant Biology, University of Chicago, and JOHN GAYLORD COULTER, Critic Teacher of Biology, University High School, Normal, Illionis. The American Book Company, New York, Cincinnati, and Chicago, 1915. 144 pp. Price, 60 cents.

There was a time when a student desiring to classify a flowering plant must needs learn a new vocabulary as a starting point. This is no longer true if the student use this little manual. The work is strikingly free from technical terms, due largely to the fact that in most cases only characters obvious to beginners are used in the key. This, coupled with the facts that usually the key leads directly to the genus with the species, and that there are many illustrations, makes analysis of a form a decidedly easy and direct process. It seems possible that even younger students than those in high schools might use the book readily.

As to the range, upward of 160 genera with about 380 species, occurring in the spring flora of the North Central and Eastern States, are described. Obviously many forms must be omitted, and the authors naturally selected for incorporation those more commonly found and more easily classified. In fact, all grasses and sedges, and most willows and hawthorns, are omitted as being too difficult for the average student. One cannot but regret that some of the common grasses could not be included, since grasses represent such generally distributed forms that a few should be among those "which every amateur botanist should know." It is to be hoped that sometime there may be a manual for beginners, approaching this one in simplicity but dealing more with the forms common on our prairies in both spring and summer seasons.

NORMA E. PFEIFFER

Department of Biology,
University of North Dakota

University Notes

The Legislature of 1915

The North Dakota legislature of 1915 faced a number of serious problems when it met in Bismarck on January 5. Most of these centered around the finances of the state, which had been allowed to drift along without adequate organization for a number of years. In addition the legislature had been stirred by criticism of the educational institutions that brought forth a distinct feeling that something should be done to coordinate and correlate their work.

From the University point of view the legislative enactments consisted of two important measures; first, the change in the mill tax appropriations, and second, the reorganization of the government of the educational institutions of the state.

As far back as 1883 the University had been given the returns from a one-tenth mill tax on the assessment in the territory. This law remained on the statute books for a number of years, until the constitution was adopted, when the plan was abandoned. However, this provision was again placed upon the statute books in 1899, and the plan of distributing one mill upon the assessed valuation of the state to the educational institutions of the state was adopted in 1901. At the same time various other mill tax appropriations were adopted, and these, because of their number, have interfered materially with the raising of the assessed valuation of the state. The conclusion seemed to be inevitable, therefore, that it was necessary to remove the incidental mill taxes, and, from the legislative point of view, in order to accomplish this it was necessary also to repeal the mill tax for educational purposes. This was done, but a substitute provision was enacted which gives to the different educational institutions a permanent annual appropriation equal to the amount which they would have received under the mill tax for the year 1915. The University income from this source was supplemented by additional appropriations for maintenance purposes.

For a number of years there has been a good deal of discussion over the problem of concentrating the management of state institutions, and this idea took the form of a board of control, first over the penal and charitable institutions, and second over the educational institutions. The work of the Temporary Educational Commission, created by the legislature of 1911, clearly demonstrated the necessity of making a distinction between the government of the two kinds

of institutions, and without doubt the delay in legislative enactment in 1911 resulted in a very much better bill than would have been passed two years ago.

Under the provisions of the bill creating the State Board of Regents all the different educational institutions are placed under its control. The membership consists of five, and the Governor has appointed five men of recognized standing and ability, so that the Board starts out auspiciously. The act also provides for an educational survey and for the creation of the office of Commissioner of Education. It provides for the budget system of management and the presentation of institutional needs to the legislature in a joint report made by the Board.

While the legislation in this direction is somewhat experimental in character, nevertheless it is hoped that something satisfactory will come out of it. When the whole situation is taken into consideration, including the condition of the state and the necessity of changes in its financial system, the legislative session of 1915 may be regarded as on the whole a satisfactory one so far as the University is concerned.

The University did not receive any appropriation for betterments in the form of buildings, altho it is very badly in need of such improvements. It is hoped, however, that two years from now adequate buildings, for the work in chemistry in particular, may be secured.

Founders' Day

The dominant note of this year's celebration of Founders' Day was the Alumni and their relation to the University and to the State. In this day when higher education is being subjected to such critical analysis and the question is frequently asked whether the State is getting its "money's worth" out of its educational institutions, the discussion of the subjects, University Women in North Dakota by Miss Beatrice Johnstone (1891), and University Men in North Dakota by George F. Shafer (1912), was timely and interesting. That they answered this question most emphatically in the affirmative was the unanimous opinion of the large crowd which filled the gymnasium at the special convocation on Saturday morning. Dean Squires of the College of Liberal Arts read a poem, "Founders' Day," written especially for the occasion, and the Junior class with Mr. Herman Wolff as choregus gave two songs with which they had won the Carney Song Contest the night before.

The annual banquet was held at 1:00 P. M. in the Commons.

President McVey was toastmaster, and toasts were responded to by Miss Margaret Plank (1914), Professor Perrott, Mr. Edgar Gustafson (1915), Hon. James Twamley, and Mr. William Langer (1906). The toasts were full of the spirit of loyalty and enthusiasm for Alma Mater, Miss Plank's, perhaps, being worthy of special mention. The evening was devoted to the Alumni minstrel show, the wonderful happenings on "Alumni Isle" being interspersed with songs and stunts by various individuals and organizations. The minstrel show was a great success as an entertainment, and incidentally served as a means of putting the Alumni Association on a better financial basis. The importance of the alumni in the development of an institution is being more fully realized, and the alumni of the University are trying to do their share. On Sunday afternoon the Philharmonic Orchestra, under the direction of Professor W. W. Norton, gave a concert in the gymnasium, and on Monday evening the University basket-ball team met and defeated the team from the State Agricultural College in the annual contest, thus securing the state championship.

Dr. E. B. Stephenson was chairman of the Founders' Day committee, and Mr. William Greenleaf, secretary of the Alumni Association, had personal charge of the minstrel show. Doctor Squires' poem is so fine an illustration of the spirit that characterized the whole celebration that it is given here in full.

FOUNDERS' DAY, 1915

I.

Today the children troop back home
To join in Alma Mater's praise;
From office, farm, and school they come
To wish her joy and length of days,
To talk of happy times gone by,
To catch a fragrant whiff of youth,
To strengthen faith and purpose high,
And pledge once more their lives to Truth.

As in the gallant days of old,
In answer to the trumpet's sound,
King Arthur's faithful knights so bold,
With jewelled swords and spurs of gold,
Came trooping to the Table Round,
Each to report his gain or loss,

Each to receive his lord's behest,
To swear new fealty to the cross,
To gain consent for some new quest,
So come we here on this high day,
We loyal sons and daughters true,
To gain fresh courage for the fray,
To kindle hope's fair flame anew.

II.

Before us through the mists of years
Come thoughts of those who long ago
Despite discouragement and fears,
Their hearts with fervent faith aglow,
Were vision-led; who caught the gleam
Of richer, better times to be,
Then, loyal to the best they saw,
Made real the figment of their dream,
Took for foundations Light and Law,
And built our University.

Then, too, we think of those brave hearts
Who through stern years of storm and stress
With courage played their straitened parts
And turned defeat to high success.
We think of teachers and of taught
Who in those days of lesser things,
With love that never could be bought,
Enhanced the worth of all they wrought
And found the joy Devotion brings.

We praise also these later years
Of growth in numbers, strength, and fame,
And join in songs and happy cheers
To Alma Mater's honored name,
Not mindless that these times of ours
Still call for men of wit and worth,
For pure intent, devoted powers,
And serious thought amid our mirth.

III.

So hopes grow strong and hearts beat fast
As to and fro Thought's shuttle glides

From blessings in the years long past,
To joy in work that still abides.
And here today we take once more
The oath of loyalty to Truth
Which Alma Mater o'er and o'er
Impressed on us in days of youth.

We pledge to keep from fleck or flaw
The honor of her well loved name;
We pledge to follow Light and Law
'In praise and in dispraise the same';
Never to turn from that high quest
Till Truth at last shall be set free;
Never on laurels won to rest
Till Dream becomes Reality.

Thus with glad thoughts of days of yore,
And hopes that light the distant way,
With faith that lifts us evermore
And guides in all we do or say,
Resolved in noble deeds to vie,
And ever greater tasks to try,
With loyal love that ne'er shall die,
We gather here on Founders' Day.

The University and Scientific Meetings Dr. Robert T. Young, Professor of Zoology, took an extended trip during and after the holiday recess covering some three weeks of time, visiting several states and cities of the East, and attending various scientific meetings. The trip was taken in the interests of the Department of Zoology at the University and of the Biological Station at Devils Lake.

At Beaufort, North Carolina, Dr. Young spent two days inspecting the laboratory of the Bureau of Fisheries, and at Washington, D. C., one day at the United States Bureau of Fisheries building inspecting the plant, and consulting with the Commissioner and his assistants regarding the problems at Devils Lake.

At Philadelphia he attended the meeting of the American Society of Zoologists in conjunction with the American Association for the Advancement of Science, and read a paper before the former body on some experiments on Protective Coloration. A little later, in the same city, he visited the Wistar Institute of the University

of Pennsylvania and attended the twenty-fifth anniversary of the Delaware Ornithological Club, one of the leading ornithological associations of the United States. This meeting was attended by a number of men from other cities and from other societies, notably the Linnean Society of New York and the Biological Survey at Washington. He also spent one day at the Cold Spring Harbor Long Island Station for Experimental Evolution, of the Carnegie Institute, two days at Wood's Hole and one at the Bussey Institute of Harvard University.

The University and the Educational Meetings

Dr. W. G. Bek and Dr. G. P. Jackson attended the meeting of the Central Division of the Modern Language Association of America, held in Minneapolis, Dec. 29, 30, and 31. The Association has been established for the purpose of encouraging research in philological and historical phases of modern languages. The program of this session was especially designed to meet the problems of teachers of modern languages in the higher institutions. A successful meeting was reported.

Dr. O. G. Libby attended the joint meeting of the American Historical Association and the Mississippi Valley Historical Association held at Chicago, Dec. 28 to 31. Dr. Libby was on the program for a discussion, but his principal purpose in attending the session was to meet with various committees having charge of the plans for publications, and other business of the organizations. It was decided that the next meeting of the Mississippi Valley Historical Association should be held in New Orleans.

Dr. J. M. Gillette attended the meeting of the American Sociological Society at Princeton, Dec. 28 to 31, and the first annual meeting of the American Professors' Association at New York, Jan. 1 and 2. The Sociological Society met jointly with the American Economic Association and the American Statistical Association. Dr. Gillette gave a report as chairman of a committee on the teaching of sociology in schools of education. The report embodied an investigation into the present status of that teaching, and a discussion of the relation of sociology to the science of education. He also read for President F. L. McVey a paper on the subject of Academic Freedom, the writer being unable to be present. The meeting of the newly organized Professors' Association was of great interest to those in touch with the movement. The session was given over to the formulation of the plans of the organization and the adoption of a constitution. The purpose is the furtherance of the interests and professional standing of teachers in American universities and colleges.

The Religious Campaign

On the last three days of February the two Christian Associations of the University conducted rather an unusual religious campaign. In methods of procedure, in form of message, and in type of leaders it was far removed from the typical form. It was positive from beginning to end—a positive message, a direct facing of conditions in the world of to-day, and a straightforward look into the immediate future of that same world. There was nothing negative about it—no avowed effort to convict of sin, no attempt to scare people into the kingdom, no attempt to paint the horrors of a hell to be shunned. This, rather, was the program: a forceful presentation of the needs of that portion of humanity which is weak and down and out, a showing of what strong men and women are now doing in these fields, and finally an attractive painting of the glory of a life of service for one strong enough to enter the lists—a challenge to men and women conscious of their power. That was all; no appeal to shun the evils of the past—merely an invitation to enter upon a difficult but worthy campaign in the service of humanity under a leadership that never fails.

The local workers of the two associations had capable assistance from the outside. The young men were assisted by Mr. Raymond Robins, Social Worker, from Chicago, and Mr. J. L. Childs, International Secretary of the Young Men's Christian Associations in the colleges and universities of Wisconsin, Minnesota, North and South Dakota. Mrs. Emma Byers, Executive Secretary of the North Central Field of the Young Women's Christian Association, and Miss Fannie Norris, Association Secretary for Normal Schools, assisted the young women. All gave themselves to the work with enthusiasm and with rare sanity, each contributing characteristic influences from a life of strength and devotion. Thoro preparation had been made and the campaign began strongly on Friday continuing till the next Sunday night. Rarely does a message of such power and inspiration come out of the world of life to the student body of any institution.

While all worked in perfect harmony and for a common purpose, Mr. Robins, thru his strong personality and his interesting life, really shaped the campaign. Born to poverty in the South in the days of privation following the Civil War, he began life as a farm hand and coal miner. Later, having overcome poverty and experiencing a desire for power over men, he studied law and soon won an enviable position at the San Francisco bar. Fortune he won in the next three years in the Alaskan gold mines. It was here that a crisis came into his life and that a resolution was formed to devote both fortune and talents to the service of his fellow men. To the fulfill-

ment of that resolution he is now giving the best years of his life. Working at one time as a common laborer on the streets and alleys of the famous seventeenth ward of Chicago that he might know at first hand the difficulties and problems of the laborer under present conditions, again, acting as arbiter to secure to the working man the just fruits of his toil, and again, acting as counsellor in the political affairs of state and nation, he is enabled thru his strong personality, indomitable energy, and sincerity of purpose to win men of thought and action to the higher things of life.

Tho Mr. Robins gave several other addresses and to different groups of people, his great message to the men of the University was contained in the following: "The College Man and the Industrial Problems, "The College Man and the Community," "Manhood," and "Mastery, the Secret of Power." Starting with the common problems which thoughtful college men are facing to-day in attempting a peaceful solution of the conflict between capital and labor, he led up to the personal problems of a young man's life. He closed with the story of his own life appealing to every man to undertake his life work in the spirit of Christian service.

The appeal of the campaign was a stirring one—one to challenge the best there is in young men and young women. There are many evidences at hand that the appeal was heard and that it is being heeded. Many there are who have been led to see, more clearly than before, that the very essence of Christianity lies in its practical application to the social and industrial conditions of to-day.

Manitoba Exchange Lectureship During the autumn of 1911 an exchange lectureship was arranged with the University of Manitoba that has been in force since that time with gratifying results. The plan contemplates a two or three-day visit to each institution by each of two men from the other. In a general way, each representative is supposed to conduct a conference and round-table discussion with the departments especially interested, and to give one or two formal addresses of a more general nature.

The present year the representatives of the University of North Dakota have been Dr. Robert T. Young, Professor of Zoology, and Dr. Vernon P. Squires, Professor of English. Dr. Young made his visit in the early part of December, giving two illustrated lectures, one before a gathering of faculty and students on "Animal Color," and the other before the Science Club on the work of our Biological Station at Devils Lake, of which Dr. Young is Director. Dr. Squires made the visit in January, the 18th and 19th, speaking three

times to large audiences. His first address was on "The Outlook for Poetry," given on Monday morning, January 18. Tuesday morning he spoke on "The Influence of the Bible on English Literature" and in the evening on Browning's "Ring and the Book." The Winnipeg press gave most complimentary reports of these lectures, especially of the closing one, "The Ring and the Book."

Both men were royally entertained at the well-known Fort Gary Hotel, and each was an honor guest at a dinner given there by the University faculty.

Our first visitor from the Northern institution this year was Dr. Robert K. McClung, Assistant Professor of Physics, who was with us on Friday and Saturday, January 29th and 30th. He gave three illustrated addresses on the following subjects: "Radio-Active Transformations," "Visibility of Ions," and "The Development of Some Recent Views in Regard to Electricity and Matter," the last being the Convocation address for the week. This address appears in full as the opening article in this number of the Quarterly Journal. Tho these were all quite technical subjects, the speaker, thru his familiarity with the general field covered, and thru his rare good sense, succeeded in so presenting them as to be easily followed by any really intelligent person.

Dr. McClung was followed in March by Professor Chester S. Martin of the Department of History. He also spoke three times, and to highly appreciative audiences. His first address discust the topic, "The Buffalo and Beaver as Factors in Canadian History." This and the second on, "Wolfe's Capture of Quebec—1769" were illustrated. The Convocation address, given on Saturday, March 20, was a masterly presentation of a great subject, "Law versus Prerogative: Evolution of British Democracy." This will appear as the leading article in the next number of the Quarterly Journal.

The Basket-Ball Season During the winter season the athletic interests of the University have centered largely around the basket-ball team. The class games held before the Christmas recess served as elimination contests for the varsity team, but there was such competition for places that there have been two or more teams on the squad all the season. The record of the team this year was an unbroken series of victories up to the first of March when they lost to the University of Minnesota, and altho two more games were lost on the trip into Minnesota, the basket-ball championship of the state is still in the undisputed possession of the University.

The plan for the voluntary purchase of student season tickets

worked so satisfactorily last semester that the Board of Trustees established a regular athletic fee of two dollars per semester for which each student is given a ticket to all University games. The athletic association also plans to sell a special alumni and faculty ticket at three dollars for the year and in this way to keep as many alumni as possible interested in athletics. With the assurance of a definite income the association is able to apply the principles of the budget system to each line of sport, and already the finances of that department are in good shape.

The final series of games for the high school basket-ball championship of the state were played in the University gymnasium March 12 and 13. The state is divided into four districts within each of which an elimination series is played for the championship of the district. The winners then come to the University for the final series. On Friday night there were games between Tower City and Bismarck, representing the southeast and southwest districts, and between Minot and Park River from the northwest and northeast districts. The winners, Tower City and Minot, played on Saturday night, and by a victory of 24 to 13 Tower City became State High School Basket-ball Champion for 1914-15.

The schedule of University basket-ball games with scores for the season of 1914-15 is given below:

January	6	Wahpeton School of Science	18	University	47
"	23	Crookston Agricultural School	10	"	38
"	20	Fargo College	18	"	25
February	12	Agricultural College	16	"	27
"	22	Agricultural College	24	"	25
March	1	Wahpeton School of Science	5	"	22
"	2	Minnesota University	23	"	10
"	4	Carleton College	17	"	11
"	5	St. Cloud Normal	13	"	24
"	6	St. Johns University	21	"	19
"	13	Fargo College	17	"	15
		Totals	182		263

Announcement

THE Quarterly Journal is a perodical maintained by the University of North Dakota. Its primary function is to represent the varied activities of the several colleges and departments of the University, tho contributions from other sources are welcomed when they are the fruitage of scientific research, literary investigation, or other form of constructive thought. Correspondence is solicited.

All communications should be addrest,

THE QUARTERLY JOURNAL,
University, North Dakota.

Editor's Bulletin Board

THE present issue of the *Quarterly Journal* is the last of Volume V. Judging from unsolicited words of appreciation, the volume has been fully equal to any that has preceded, and articles already presented, or known to be in preparation, warrant the assurance that Volume VI will prove equally interesting. The first number, that for October, 1915, will represent the mental and moral sciences. Dr. Vernon P. Squires, head of the department of English, will give a study of Browning's *Ring and the Book,* and Professor Frederick H. Koch, in charge of Dramatic Literature and Oratory in the same department, writes of the *Municipal Theater.* Dean Kennedy, of the School of Education, contributes an article on *Educational Perspective,* a careful study meriting the title. Professor Sumner, University librarian, in an article on *State-wide Use of the University Library,* clearly describes one way by which the modern university serves its constituency. Dr. Brush, head of the department of Romane Languages, writes on a strictly pedagogical subject, *The Teaching of Modern Language Composition.*

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The Quarterly Journal

VOLUME 5 JULY, 1915 NUMBER 4

The Evolution of America*

FRANK L. McVEY,

President of the University of North Dakota

I am taking it for granted that the audience which has gathered here for the purpose of listening to what I may have to say will be interested in America. The topics chosen for the two lectures deal with certain phases of national development. The first lecture bears the title *The Evolution of America.* The second has been designated *Recent Social Tendencies in the United States.*

Undoubtedly you feel with me that I have undertaken much to tell the story of a nation, even tho it be that of a young nation, within the confines of an evening lecture. Still in that length of time an outline can be placed before you so that there may be a clearer concept of what present-day problems mean in this western land. Without the historical background it is impossible to understand even in a limited degree what is now taking place in the United States. Nor must we overlook the important fact that there has been going on in the United States for 200 years the largest experiment in Democracy that has ever been undertaken in the history of the globe. During this time men have turned to it as the hope of democracy; of late their hopes have been dimmed by what they beheld in the seeming domination of industrialism and the lowering of the ideals of the founders; but that, too, may be regarded as a part of the evolutionary process thru which it will be necessary to pass before real democracy of its own volition rules in America.

In the books of history the year 1776 stands famous for achievement. In that year the Declaration of Independence was written and Adam Smith's *Wealth of Nations* published. It likewise marked the line between the old and the new system of production, the awakening of democracy, and the dawn of modern industrialism.

* President McVey spent the summer of 1912 traveling in Europe. While the trip was being planned, he received an invitation from the University of Christiana to deliver two addresses at that institution dealing with conditions in America. He spent a portion of the month of September in Norway, and on the 4th and 5th gave the addresses in question. The article here presented on **The Evolution of America** is the first of two. The second, discussing **Recent Social Tendencies in the United States,** will appear in a subsequent number of the Quarterly Journal, probably that of January, 1916. (Editor.)

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It is not to be wondered at that America's history so clearly identified with this period of awakening should show so many phases akin to those of the times. The key, however, is not to be found in the story of Europe, but rather in the settlement of a vast territory by waves of population that have prest continually toward the West. This interesting phenomenon has been continued, thru the addition to the territory of the nation, until the last decade of the nineteenth century, but it has been accompanied by the exploitation of natural resources, the setting up of a political philosophy of *laissez faire,* a conflict of interests and the struggle for supremacy by the people. Nevertheless, until recent years there was a real democracy in the United States, because the society created was based upon essential equality in material possessions and the contest for wealth was undisturbed by the organization of vast capital such as now comes in. With the combination of both men and wealth an increasing inequality has made its appearance accompanied by the multiplying of occupations, the widening of the breach between rich and poor, and the enlargement of the differences between the cultivated and the uncultivated. The processes of this evolution are already to be observed in the larger cities, but as yet the old democracy of material possessions holds true to the original basis of national growth in the country districts and smaller towns. There is as a consequence uncertainty as to whether the same phenomena will take place in agricultural America, and if it does what will be the outcome. Are we to have a land-holding class, a peasantry, and all the social phenomena to be observed in Europe?

Comparatively easy as it is for the American to recognize the fundamentals of development in his own country, it has been difficult for the European student to grasp the essentials of a movement so different from that seen in Europe. The contrast at the time of the opening of the Industrial Revolution in England between the conditions seen in America and those found in England will bring out more clearly than perhaps anything else the change that has taken place in the United States. England entered upon the industrial revolution at the opening of the nineteenth century with well developed political institutions. The people of America began their industrial revolution with a newly formed constitution, with a national debt, and with a small conception of the vast changes that were to take place in their country. A new order was created in the industrial system in England between the Declaration of Independence and the Battle of Waterloo; in America successive waves of population followed each other across the continent. The savage

was succeeded by the hunter, the hunter by the trader, the trader by the rancher, the rancher by the farmer, and the latter by the manufacturer with his accompanying organization of city and factory system. In time the period extends a hundred years after the adoption of the constitution; the movement has been now quick, now slow, in the development of trade, commerce, transportation, and manufacture.

Cultivated farms, towns, and cities were the possessions of England when the great industrial changes began; in America the people were compelled to conquer forests, to make roads and bridges, and to subdue nature. The story of English growth is the story of an organized society gradually casting aside the old and accepting the new, while the history of America is the story of free land, its settlement, and the advancement toward the west of American civilization,—a story, indeed, of reversion to primitive conditions on a continually advancing frontier line, where the social development of the last settlement was restarted and replanted. The Americans were an expanding people, demanding in some cases new institutions and in others the alteration of those brought to American shores by the English. Thus social development was continually beginning over again on the frontier; it was productive of excessive individualism, creating as a result a "free land democracy," intolerant of restraint and lax of government, and leading in the long run to difficult problems which have been obliterated or entirely avoided in countries where democracy was an evolution in a limited area instead of an expansion over a vast territory.

In America the movement was largely that of an unfolding of industry giving the laborer plenty of time to adjust himself to the new conditions. There was no landed aristocracy, land was free to every man, and he could undertake its cultivation if he wished, and employ such capital and labor as he possest. Every farmer was his own landlord and his own laborer. Outside of a few office holders all classes were merged into one great class, a condition due to the fact that no one would be a laborer and work for wages when he could get land of his own to cultivate. In consequence there was a social uniformity and equality prevailing in America in strong contrast to that existing in England. As the laborer had the option of working with his own tools, he was always able to secure the results of his labor. In these earlier days he occupied the position of capitalist, manufacturer, and manager. Perhaps no one single instance typifies the status of society so well as does the position of the man who labors with his hands. In America

this is particularly true, and the democracy existing in the land has been mesured by the ups and downs of the common man.

For the purpose of guiding the discussion of the evening and at the same time emphasizing the periods in the history of the country, it will be necessary to call attention to seven different epochs into which the history of the United States may be divided. The first of these is the time of colonial adjustments, lasting from 1608 to 1776. This is followed by nearly fifty years of national formation, appropriately ending in 1820. From that date on to 1850 it is possible to speak of the rise of the West as a dominating factor. Beginning in 1850 and lasting to 1870 is a period that can be referred to as the conflict of sections, in which the Civil War occurred. The fifth span of time is marked by the railroad and industrial development of the twenty years from 1870 to 1890, and this was followed, almost as a matter of course, by a decade of consolidation and monopoly, bringing us to the close of the nineteenth century. The first ten years of the twentieth century, the seventh period, marks, appropriately enough, the beginning of the era of political reforms and social awakening. In the consideration of any period in the history of the United States it can not be imprest too strongly upon the student that every period is one of transition, not only in governmental development but in the expansion of industry, and the enlargement of the frontier.

Let us discuss briefly these periods in the order named:

I

Period of Colonial Adjustments

1608-1776

The two and a half centuries of colonial history show many social and industrial phases that are the forerunners of later developments in both government and industry. Left alone by the English kings, the colonies were allowed to grow in their own way. Thus there appeared along the Atlantic seaboard many types of colonial organization. From time to time the colonies were forced into something like co-operation with each other because of the presence of warlike Indian tribes and of hostile European neighbors upon their borders, They quarrelled among themselves over the intercolonial traffic, developed ship building, carried on agriculture, and created a commerce with the West Indies and Europe that brought them, in time, in conflict with the economic interests of the mother country. The specific things for which the colonists stood were representative government, liberal laws as applied to their trade, and full owner-

ship of the soil. There was from the beginning a scarcity of labor; there was a lack of capital and a dearth of wealth for a monetary system. Needing quick returns for effort, settlers began at once the exploitation of natural resources. Slavery soon made its appearance, troubles over monetary standards arose, and a rampant individualism grew out of the conditions that acceeded grudgingly to the comments of a distant government. In this struggle with nature, however, a fine type of man and woman was developed, ready to meet difficulties and anxious to create, in a new country, social institutions that would be lasting. The colonies emerged from this period with the outline of government well developed. The conflict between the executive and the legislative had been fought, the control of the purse determined, and the principles of representative government fully established. But monetary standards, banking, and control of commerce were still problems that could not be solved by the small individual colony since its authority did not extend into the territory of its neighbor. More important than these advances were the spirit of the people and their feeling of loyalty to the principles of representative government.

II

National Formation

1776-1820

As a consequence of her success in the Seven Years' War England had become an empire; when the second period opens the neglected colonies were no longer to be neglected by the mother country and the principle of the mercantile system which had been remoulded by the genius of Oliver Cromwell was to be applied once more to the English plantations. Such action threatened the freedom of government, the freedom of trade, and the freedom from taxation which the colonies had enjoyed. The problem from the English point of view was largely a matter of applying in a thoro-going fashion the mercantile system of an earlier day as the basis of the relation between the mother country and the colonies. The restrictive mesures determined upon in the deliberations of Parliment aroused irritation, and resulted in the Declaration of Independence and the Revolutionary War.

The two belligerents, mesured by the conditions under which they fought, were about equally matched. The Americans were hampered by lack of union, poor organization, and failure of credit; while the English were at too long a distance from their source of supplies, were indifferently led, and were divided at home upon the

policy of the war. This conflict for the independence of the American colonists presented two phases. Of the first much has been written but of the other little has found its way into the books. The revolt against English rule was the work of the people of the Atlantic seaboard, while the winning of the western territory, which has proven to be the great heritage of the nation, was brought about by the pioneer settlers who had pushed their way over the Alleghanies into the valleys of the Ohio and the Tennessee. In a single year, 1788-1789, a writer of the early day tells us that 20,000 people, 7,000 horses, 3,000 cows, 900 sheep, and 600 wagons passed Fort Harmon on the Ohio. This is an example of the moving into the West, whose very bigness was absorbed into the settler's makeup, which accounts in the main for the struggle with the English and Nor is it to be overlooked in the hurry of writing history that the Indians long after the articles of peace had been signed in 1783. placing of settlements on the Mississippi, the use of the great river as a highway to market, and the belligerent note of settlers in the Valley hastened the elimination of Spain from American territory and facilitated the Louisiana purchase from Napoleon.

Having been freed from the English colonial policy as a consequence of the Revolution, the people of the United States anticipated with eagerness the opportunity to enter into larger trade relations with other nations. They were doomed to disappointment; the governments were unwilling to consider negotiations with a state so insecure and possessing so little authority. The Continental Congress that had held tenaciously to its power broke down before the war was finished, and the Confederacy which succeeded it fared but little better in the interval between the treaty of peace and the formation of the constitution. It became clearer as time went on that the Americans must have a central government which should possess common authority over interstate trade, the issue of money, the declaration of war, the maintenance of troups, etc.

The commercial independence thus hoped for did not come until after the second war with Great Britain. Meantime, the nation, having established a constitution, began to create the necessary factors in the governmental organization; and so a tariff policy was established, a national bank organized, a monetary plan created, patent laws made into statutes, and the governmental organization developed. Thru the wise leadership of Washington, the far-seeing capacity of Hamilton, and the judicial shrewdness of Marshall the Federal government was finally formed and made a definite part of the national organization.

III

Rise of the West

1820-1850

While the treaty of 1783 gave to the United States the territory east of the Mississippi, it was only the beginning of the problem, since government must be established and order maintained therein. The famous Northwest Ordinance of 1787 laid down the principles of organization for the new territory and formulated the rules upon which future states should be created and the methods of bringing local governments into existence. Congress was called upon to administer to the needs of an empire and to provide governmental machinery. This task was, in the earlier stages, more than it could well deal with in view of the finances and weaknesses of the general government operating over vast distances. Tho the thought of law and order was instinctive in the larger sense, to the settler the requirements of a remote government seemed unnecessary and quite in opposition to his sturdy individualism which was willing to build roads and bridges if needed or fight the Indians when called upon to do so. In fact the West has ever been a gate open to the poor, the discontented, the oppressed, and the ambitious. It gave opportunity for new careers, and a chance to build homes on new lands. "Abundant space in America has meant abundant opportunity and a chance for all to rise; it has developed in the American a powerful initiative and encouraged the democratic spirit." While doing this and while endowing the American people with one of their greatest qualities, it has at the same time increased the difficulties of government and made cooperative effort harder to secure in an atmosphere of intense individualism.

In the South and Southwest new states were being moulded from the territory acquired by the nation. There the cultivation of the staple product, cotton, was introduced, and the industrial organization of the tide-water lands in the Carolinas and Georgia established on new soil. The Americans from the Atlantic seaboard were filling the Northwest Territory, and upon the acquirement of the Louisiana Purchase in 1803 the settlers upon the eastern side of the Mississippi pushed into the new possessions and took up lands there.

IV

Conflict of Sections

1850—1870

As this process of settlement went on in the North the slavery system was extended in the Southwest. And the cotton crop, having increased materially in value, now became an important economic factor which took away from slavery much of the family spirit with which it had been associated in the earlier history of Virginia. The figures of cotton production in 1811-1820 bring out the extent to which the commercial process had gone. In the first year, 1811, five million pounds of cotton were produced in the southland, and in the last named, 1820, sixty million. In the meantime the predominance of New England in national affairs had declined and its relative importance decreased as a factor in political life. This change in political dominance was indicated by the failure of the Federalists to hold the control of government after 1824 and the appearance of a new party under the leadership of Jefferson. Likewise there appeared an increasing tolerance and a marked bearing away from the religious dominance of any one church.

Changes, however, in the life of the nation were not confined to political or religious ones, but economic and social conditions were materially modified in the next quarter of a century. The national bank established largely as a result of Hamilton's report in 1791, was refused a recharter in 1811 only five years later to be reestablished and extended for twenty years. About this bank, nevertheless, waged the great political warfare from 1827 to 1837 resulting in the abolishment of the bank and a remarkable modification in the economic organization. The state banks were created and many private ones brought into existence as a consequence of the downfall of the National Bank. There set in at once a period of land speculation, wild-cat banking, and depreciated currency that was intensified by the panic of 1837 and which lasted for a number of years. Looked at from the vantage ground of the present, this period is regarded as the time when democracy, meaning the rule of the people, had been in a mesure lost. The vigorous exponent of this democracy in the middle west was elected president in 1829 and held the office until 1836. Andrew Jackson may be said to have brought the actual rule of the people nearer to a realization than any of his predecessors.

The movement of population referred to previously soon found its way to considerable distances from navigable streams and as a

result raised new questions of transportation. The Erie Canal was the forerunner of the means of transportation, solving in some degree the difficulties that had arisen thru the pushing of the settlers westward. For twenty years after the panic of 1837 there was a marked expansion of transportation facilities in the form of canals, roads, and a few railways sufficient so long as the settlements were confined largely to the Ohio valley. So soon, however, as the immigration moved beyond the great rivers the difficulty of transportation became more pressing. All of this effort to produce wealth began to show in a larger per capita possession. The discovery of gold in California was hailed as a great event frought with meaning for larger national wealth. The merchant marine, under the stimulus of the low cost of ship-building, developed by leaps and bounds. Moreover, there had been a steady movement towards a low tariff, and manufacturing, despite this so-called handicap, continued to flourish. It was a period too, of internal improvements many of the states levied taxes for the building of roads and canals, which supplemented in some measure the capital of New England, that had been created thru manufacturing, sea traffic, and fishing and was now being used to build canals and railroads. Perhaps even more important was the granting of federal aid in the form of land and money for the establishment of such enterprises. The banks that had been plunged into a period of speculation after the destruction of the United States Bank had re-established themselves between the years 1843 and 1853, and now under the influence of the internal improvements movement had entered into financial speculation that finally resulted in the panic of 1857.

While the North was thus progressing in the matter of manufacturing, railroads, and transportation facilities generally, the South had become more markedly commercial in its method of dealing with the cotton industry. In the early days, from 1790 to 1800, there was a stronger anti-slave sentiment in Virginia than in New England. Even as late as 1831 an emancipation bill had been debated in the Virginia legislature, and in 1849 the Kentucky legislature took up a mesure of that kind. Emancipation by slave owners was a common thing, and it is said that in the decade before the Civil War over twenty thousand slaves were set free, while in 1860 the free colored population to be found in the United States number half a million. This movement was restricted by the fact that there was no place for the free negro in the American system either of government or industry. Cotton, however, became more and more an economic factor not only in the life of the southern

states, but in the industry of England and of New England. By 1840 the capital invested in plantations growing cotton amounted to 327 millions of dollars, and it was clearly demonstrated, at least to the satisfaction of the planters, that large scale production required negro labor. As history has shown, the money interest in slave labor, as in the case of many other things, intensified the problem and finally resulted in carrying it into the legislative halls. The question as to which policy should control and how far slavery should be extended into new territory was developed by the constantly westward pushing population. and finally thru many phases brought on what is known in history as the Civil War. The North was a great industrial and manufacturing section, while the South was a vast agricultural region devoted to cotton cropping. The property in the North was worth more than eleven billions of dollars, while that in the South was worth less than one-half of this. Two billions were invested in slaves and one and one-half billion in the property devoted to cotton raising.

V.

Railroad and Industrial Development

1870—1890

The termination of the Civil War brought many results, and with its ending a new epoch is marked in our national history. It was clearly demonstrated that the federal government was superior in its authority to that of the individual states, slavery was checked, and many other questions solved as a consequence. But the government of the slave states, and the money and banking question still remained important for the consideration of the people.

The problem of reconstruction confronting Congress was threefold in character. The first phase was to restore the confidence of the people of the South and give them a part in the federal government without straining the machinery of government. The second problem was the negro. What to do with him, how to make him a citizen and at the same time hold him in the southland as an economic agent. There were also problems of finance brought on by the losses of war, heavy debts and the annual interest charges. Besides, France and England had raised serious international problems, the first by her conduct in Mexico and the second thru her neglect of international curtesies in the Alabama case. Such in the main were the political and governmental problems awaiting solution at the close of the Civil War.

The clumsy device of national banks was brought into existence

as the outcome of the Civil War and in it were to be found many of the elements of the modern system; but the old pressure for cheap money was still felt because of the lack of capital in agricultural districts and a general misunderstanding as to the purpose and function of money. The war was followed by a rush for new lands, the extension of railways, and the beginning of the period of industrial development that lasted until 1890. The war prices and war tariffs inaugurated as a consequence of governmental action, together with the other conditions, brought on a period of speculation, of over-buying, of expansion that resulted in the panic of 1873 and a check to the industrial debauchery of the time. In this period, however, many things took place. The homestead land acts were passed, opening to settlers the Indian territory and the new lands in the possession of Congress, the labor movement was revived, transcontinental lines were projected, and many attempts at legislation looking towards regulation were introduced. Public education became more and more marked; the states in the northwest endowed the public schools with large areas of land and the federal government grants for state universities were being utilized for the establishment of great institutions of learning. The period was also marked, however, by many disturbances,—the strikes of 1873 and 1883, the industrial depression of 1884, and particularly the farmers' movement, which was a protest against the policy of the railroads in managing their freight business, especially the rates that were placed upon the movement of freight from the interior to tide-water. Nevertheless, there was an immense growth in agricultural exports, and as the period passed a gradual adjustment of railroad matters took place, and some relief from these growing pains of the nation was to be discerned by the passage of the Interstate Commerce Act of 1887. But the problem of money legislation had continued and from the paper money of the Civil War period the demand had passed to that for silver legislation; but this matter was finally settled in the great campaign of 1896 by the confirmation of the gold standard as the basis for money in the United States. In the meantime the Southern states had awakened from their lethargy, due to the Civil War and the period of political reconstruction which followed, and were beginning to use their resources to build railroads and to establish themselves as an industrial region.

VI

Consolidation and Monopoly

1890—1900

A great difference of opinion on the money question existed as between the East and the West for the same reason that the earlier settlers of the Atlantic seaboard had resorted to paper devices for money purposes. The silver purchase act of 1878 and that of 1890 were passed to meet this feeling but both were repealed in 1893. Recovery from the depression of 1884 and the panic of 1897 was slow, but the results taught their lesson and the march toward a renewed prosperity began. In the previous periods attempts had been made by the railroad companies and corporations to protect their interests thru the formation of pools. These however, were discouraged by state law, and out of it came, as a consequence of the extension of competition, the ingenuous system of trusts. The Sherman Act of 1890 prohibited the continuance of any organization that looked toward the restraint of trade, and in order to avoid what was so clearly implied by the law, the "trust" passed into the form of the great corporation. On good authority we are told that the capital of newly formed combinations in the year 1899 reached three and one-half billions of dollars. This in itself was sufficient indication of the extent to which combination had taken place. The United States Steel Company, the largest single corporation created, is another example, while numerous instances might be mentioned of the amalgamation of railroads into systems coming under the control of comparatively few persons.

Meantime, the census of 1900 showed a marked change in the national situation. The Mississippi Valley is no longer the edge of the country, but the core and dominant factor in it, while the center of population crossed the state of Ohio and is now found in Indiana. The westward movement of population continued, but at a distinctly diminishing rate, while the frontier, which had been so marked a factor in the history of the nation, was no longer spoken of in the reports of the census experts. A study of the export and import figures, together with a consideration of the traffic and industry in the country, shows that the United States had reached the stage of self-sufficiency so long desired by the production statesmen.

VII

Era of Political Reform and Social Awakening

1900—

The last period is one that may be designated as a time of awakening. The people had come to a clearer recognition of the trend of things. The glamour of material wealth, and national greatness in the markets of the world had lost much of their fascination, and a more definite view of the real purpose of national life was substituted for the indefiniteness of thought that had been the possession of the average man.

The Interstate Commerce Act governing common carriers had been modified in 1904 and 1907. The schemes for the control of gigantic railroad combinations were checked by the decision of the court in the Northern Securities Case. The legislative actions of the courts hindered the consolidation movement, while the tariff policy of war memory was looked upon as an evil to be remedied. Everywhere there was a clearer recognition of what government means and what the problems confronting the people were. The centralizing of banks, railroad companies, and industrial corporations went steadily on. The appeal to the nation's sense of greatness and of world commerce brought it under the spell of a gigantic industrialism. Free land had disappeared. Irrigation was suggested as a means of supplementing the opportunity of the earlier day by the utilization of great desert areas. Legislation was enacted to check immigration, and there was a hardening of the lines of social cleavage to be found everywhere. Together with all this was a clearer recognition of the trend of government, and a fear was present manifesting the basis of the demand for a larger democracy, for the establishment of the initiative and referendum, the creation of the primary ballot, and the recognition of universal suffrage. There is also with all of this demand for a larger democracy a recognition of efficiency as a factor in government.

In this story of three centuries, it would appear from what has been said, that a great deal of history has been crowded into a short period. We are approaching in the United States more nearly European conditions. Progress will be less rapid in the future than in the past. Free lands as the basis of a great democracy have passed away, and now the United States will enter upon a period of adjustment, in the course of which there must be worked out the necessary machinery for the conduct of government in a republic on the basis of the recognition of the rights of a people to govern themselves not under the simple conditions of a hundred years ago, but under those of the present.

Law *versus* Prerogative: A Sketch of British Democracy*

CHESTER MARTIN,
Professor of History, University of Maintoba

Mr. President, Ladies and Gentlemen:

In the complexity of modern conditions one feels sometimes that it is possible so to tamper with things which may originally have been almost altogether good, that the final result is almost altogether bad. It may be worth while at times to try in some way to get back to "first principles" despite the fact that British methods at least are notoriously chary of abstract ideas. My aim therefore this morning will be seen to be a very ambitious one: so ambitious in fact that it will be open at almost every point to the charge of generalizing without making the necessary qualifications. But qualifications to be discriminating would take my hour before I had surveyed a tithe of my subject. One must choose between moving rapidly and getting nowhere; for the subject which I ventured several weeks ago to suggest for this address was nothing less than a survey of the development of British democracy, and an inquiry into the general principles, if there can be said to be any, which may be said to indicate this development.

This return to "first principles" is particularly difficult in British history because our constitution (as you know) like Topsy "just growed." It has been profoundly altered as recently as 1911 by the Parliament Act of that year. We have no written constitution, no permanent and unchanging expression of principles or of theory such as your Declaration of Independence or the Constitution of the United States. Even the Acts of Parilament which, in the course of time, have altered so profoundly the relationship between crown and parliament, and between the Houses of Parliament themselves, have sought to secure always the practical objects demanded by the people, and have consigned theorizing and idealizing to the limbo of all things un-British and unprofitable. My point then is that these "first principles" in the case of the British nation are to be found only in the history of the British people; and if you will bear with me I want to examine, if I can, three or four stages of our history to see if it can be made clear what our democracy has been trying to stand for—what we believe, in fact, it is trying to

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stand for now, in this life and death struggle which we have undertaken. It is needless, I hope, for me to assure an American audience that I shall try to interpret no beliefs and no opinions but our own.

It is curious that the democratic tendencies of the Anglo-Saxon should have been revealed with the first dawn of authentic history upon our race. The Roman historian Tacitus in his *Germania* accentuates above everything else the surly independence, the rude but sturdy liberty of the Germanic peoples. The folk-moot, he says, assembles with every disregard for rigid authority. Whether king or chieftain, the speaker is accorded a hearing on account of age or noble birth or reputation in war or eloquence, and by gifts of suasion rather than by right of authority. They dwell apart in surly isolation. Royalty was almost exceptional. Even where it obtained, it is clear from the simple words of Tacitus that it implied little rigid authority, little indeed but vague sanctity arising from mythical descent from the gods. And just as the child may be said to betray in a thousand unguarded ways the potentialities of the youth and of the full-grown man, the aptitudes of our Anglo-Saxon forefathers may be observed in primitive simplicity in this first authentic picture of our race less than a century after the Christian era. There is rude material plenty on the one hand, liberty with its defects on the other. The rude plenty, like the irresponsibility of the child, indicates an environment where the unfettered aptitudes of the race are to be observed in natural simplicity before overcrowding, conflict, migration, and conquest, have forced the development of unnatural and in some cases sinister forces of a later age. If the child is father to the man, perhaps the Anglo-Saxon in the northern forest may be called the father of Magna Charta and the revolution against the Stuarts.

These unnatural and sinister forces, however, are the predominant features—on the surface—of Anglo-Saxon development for many centuries to come. Migration to Britain required a strong permanent personal leader. The more or less temporary war-leader of Caesar and of Tacitus—*dux*—becomes the permanent king —*rex;* and about the king clusters the class of *thegns*, dependent upon the king for royal favour and associated more and more with the king in the functions of government. It would be unnecessary to remind the student of British Constitutional History of all the influences that led to the supremacy of the crown and to the development of Anglo-Saxon feudalism long before the Norman Conquest. The very process of conquest and settlement both increased and stereotyped these tendencies. The defence of England against the

Danes, for instance, effectively united Anglo-Saxon England for the first time under the West Saxon monarchy; and above all the Norman Conquest meant that the Norman kings begin in the eleventh century with feudalism under their feet—an absolutism which one seeks in vain for centuries to come in feudal Europe. And finally Henry II by establishing a royal system of judicature reached the highest point hitherto attained by royal power in England: an absolutism which was the more complete in that even the shire-moot, the obscure but probably the lineal descendant of the primitive folk-moot, was drawn into royal service. The law, it is true, was folk-law —custom or common law—but the justice was the king's justice and the fines were the king's revenue.

It is scarcely to be wondered at, therefore, that our race has seen in Magna Carta the vindication for the first time on a national scale of the primitive aptitudes of the nation against John's abuse of the royal supremacy won by his father. Magna Carta may be said to have meant that the crown which had subjected the whole of England to a more or less uniform law should not itself be outside or above that law; or as Maitland has finely said, it determined once for all that the king is and forever shall be under law. Every great power in medieval Europe, it would almost seem, was doomed to experience a spell of absolutism, like an attack of measles, before the full powers of manhood could be expected to appear. It was our good fortune to get the worst attack of measles over so early in our history. French absolutism was a much slower and more difficult process; and the means by which it was attained were such that the king was compelled in self-defence jealously to retain in his own hands all the powers which he had won. Uniformity in law and taxation, indeed, were never secured under the old régime. Liberty was attained in France only after the upheaval of the French Revolution and under the impulse of a theoretical, almost a philosophical, stimulus—the Rights of Man. In England, liberty was attained by radically different means: by practical measures with little theorizing; by slow steady progress on the ground; by evolution rather than by revolution; by a steady movement inspired not by the Rights of Man but by the birthright of every Englishman—'the ancient and undoubted birthright of the people of England' as it is termed in the famous Protestation in 1621 which James tore with his own hand from the Journals of the House. Even the revolution against the Stuarts was in that sense 'preservative' rather than destructive; it was inspired not by hopes of political millenium but by the spirit of Magna Carta in which the whole nation was now in a position to participate.

The thirteenth century was the century of parliament, just as the twelfth century was the century of law; and here also the keynote is the power of the king. The student of British Constitutional History does not require to be reminded that Parliament in its beginning was not democratic but royal; and was largely actuated by the same considerations as Henry's centralization of law, namely, considerations of pounds shillings, and pence. Henry II sent his justices to the shires to make money by way of doing justice: 'Justitia est magnum emolumentum.' Edward I summoned representatives from the shires and boroughs to vote money in a central representative assembly, because only so was it possible to secure uniformity of taxation and of direct influence by the personality of the king. Here again there were tendencies at work which perpetuated royal control even after the reluctance of parliament had been overcome by generations of training in political activity and of participation in great national issues. The king granted new privileges willingly because these privileges involved financial responsibilities; parliament accepted many of their privileges reluctantly for the same reason. The Wars of the Roses, the New Monarchy of the Yorkists, the 'popular despotism' of the Tudors, all obscured the slow and at times almost imperceptible growth beneath the surface. Henry VIII rode rough-shod over what is in many respects the most revolutionary period in our history; Elizabeth could at times be as imperious and almost as absolute as her father because she personified the nation in its splendid isolation and defiance of the power of Spain; but the time came under the Stuarts when foreign danger was removed and the nation could put its house in order. And just as Magna Carta was the vindication of the nation against the irresponsible supremacy of the crown over law and feudal England, so the Puritan Revolution and the Revolution Settlement under William and Mary—in reality one movement interrupted by the Restoration of Charles II and James II—may be regarded as the vindication of the nation against the irresponsible prerogative claimed by the crown over parliament.

It would be impossible here to trace this conflict in the great issues of religion, of foreign policy, of taxation, and of personal liberty; but two instances may suffice to illustrate the British method of dealing with practical issues first and with abstract principles perhaps not at all. One of the most acute conflicts arose over the right of the king, by virtue of royal prerogative and without consulting parliament, to levy increased duties on imports. Had the king carried his point, he might have been able, at a period of

phenomenal commercial expansion in England, to make himself financially independent, and parliament would have lost the one invaluable weapon—parliamentary control of taxation—by which almost every great concession has been extorted from the crown. The point came to an issue, in the Courts and in Parliament, in the famous Bates case: a tax of a penny or two on a pound of currants. Similarly the great question of personal liberty was fought out on the technical legal question whether, 'by the special command of our lord the king' was a legal return to a writ of Habeas Corpus: in other words whether the royal prerogative could override the spirit of the common law and dispense with the safeguards of personal liberty. Here then once for all was settled for us the question of the ages: whether ours was to be an 'enlightened absolutism' as Bacon and James I wished to make it, or a democracy, slow, blundering, and indeed ignorant as it then was, but growing with the centuries in the application of justice to the relationships of man to man within the state. Prerogative, as Coke the great lawyer contended, was not outside, nor above, but inside the law. It has cost the head of one king and the throne of another, but that trenchant declaration still holds true. The amplification of that idea may almost be said to be the story of British development from that day to this: the vindication of equitable law over irresponsible prerogative whether of kings or of classes or of masses or of nations.

If this crisis under the Stuarts then can be called the watershed in our history between 'enlightened absolutism' and democracy with all that this implies, one may pause for a moment to trace elsewhere the formulation of the principles which it has been the work of British democracy to eradicate from our conceptions of the state. Monarchies in Europe had already been dominated for more than a century—since the reign of Ferdinand in Aragon and the French invasion of Italy—by the political wisdom embodied so largely in *The Prince* of the Florentine Machiavelli;* and I do not wish to be misunderstood when I suggest that never in history has this political wisdom of 'enlightened abolutism' found a higher or more efficient expression than in the Prussian state of Frederick the Great or the Prussianized German state since the day of Bismarck. The absolutism is the absolutism of Machiavelli; the enlightenment is the enlightenment of Treitschke.

"It will ever remain Machiavelli's glory," says Treitschke,

*—'I shall omit speaking of commonwealths, as having discoursed of them largely elsewhere, and write in this place only of principalities, and how . . . the said principalities may be governed and maintained.'—**Il Principe**, Ch. 2.

"That he set the state upon its own feet . . . and also, above all, that he declared clearly for the first time: 'The state is power.'" One can scarcely fail to be struck with parallel after parallel upon this theme, not only between Machiavelli and Bernhardi in *Germany and the Next War*, but between Machiavelli and Bernhardi's teacher, Treitschke himself, the 'great national historian' (as he is not unjustly called) of modern Germany. 'We must distinguish,' says Treitschke, 'between public and private morality'; and there is Machiavelli's 'reason of state.' 'To maintain itself,' says Treitschke of the state, 'that is absolutely moral.' Weakness is 'of all political sins the most reprehensible, the most contemptible; it is in politics the sin against the Holy Ghost.' 'Legal obligations must in the last resort be subject to the state's own judgement.' 'A prince,' says Machiavelli, 'cannot or ought not to keep his pact when the keeping of it is to his prejudice and the causes for which he promised removed.' It is necessary of course to remember that the 'prince,' in Machiavelli's mind, is here identified with the interests of the Italian state of Machiavelli's own day, and that he is discussing not private morality but a subject from the discussion of which for the time being considerations of morality, he felt, could with profit be excluded. And what of 'frightfulness' as a policy of emergency? 'A prince,' says Machiavelli, 'is to render himself awful in such sort that if he gains not his subjects' love he may eschew their hatred. . . . A prince, therefore, is not to regard the scandal of being cruel . . . seeing that by some few examples . . . you may be more merciful than they who by an universal exercise of pity permit . . . disorders to follow.' In other words, the prompt execution of innocent hostages—shall we say?—and the ruthless extermination of civilian opposition to an invading army, will mean, even to the conquered country, less bloodshed than a vacillating clemency which protracts opposition and keeps the fury of resentment still at white heat. In the one case the initial evil is followed by strong and efficient government: things become better and better. In the other, even benefits are forgotten in recurring and necessary violence: things become worse and worse.

All this, in Machiavelli's mind, is based not upon diabolical ingenuity for evil but upon the very nature of such a state; rather upon 'the essential verity than the idealization of the thing.' And 'since the state is supreme power,' says Bernhardi, 'might is at once the supreme right . . . and war gives a biologically just decision, since its decisions rest upon the very nature of things.' 'A prince then,' says Machiavelli, 'is to have no other design nor

thought nor study but war and the acts and disciplines of it.' Has there ever been seen, before this generation, such an example of Machiavelli's 'armed nation' as the modern German army? Machiavelli wrote his *Arte della Guerra* in the cause of an 'armed nation' to rescue Italy from the contempt into which she had been brought by *condottieri.* One may note in passing the curious coincidence that even British regulars appear as 'mercenaries' in German estimates of that 'contemptible little army,' and that a book of Baron von der Goltz, for a time German governor in Belgium and now in command of the Turko-German forces in Turkey, bears the suggestive name *The Nation in Arms or the Practice of War.*

It would be a mistake, however, to leave the impression that this is merely a striking but fanciful parallel, based upon casual extracts even from such representative minds as Machiavelli in the one case and Treitschke in the other. Just as Machiavelli's *Prince* may be said to represent the precipitate, so to speak, of Italian statesmanship of that generation, so Heinrich von Treitschke may not unjustly be regarded as the 'great national historian,' as Bernhardi calls him—the exponent, among the ruling classes of Prussia during the last generation, of the fundamental ideas and policies which culminated in the Prussian state of Bismarck, and have captivated by their success the German mind. The very cradle of Prussia proper was a foreign territory conquered by force of arms, from the day when the Teutonic Knights were commissioned by Poland to conquer from the Slavs the lands at the mouth of the Vistula. At the Reformation the Grand Master of the Order, who belonged to the house of Hohenzollern, turned the fief into an hereditary principality because the old order was 'not pleasing to God and not profitable for man.' Prussia fell in time to the main line of Hohenzollern, the Electors of Brandenburg; so that the greatness of Prussia has been the greatness of the most successful ruling house of modern Europe.

The rise of Prussia from the time of the Great Elector in 1648 to the Iron Chancellor, Bismarck, must be said to justify, if justification can be found, the conception of *power* as 'the be-all and the end-all of the state' whose 'highest moral duty,' as Treitschke says, is to 'safeguard its power.' Even the Great Elector had an army of 30,000 men; Frederick William I, the first king of Prussia, maintained his army of 85,000 men, the finest troops in Europe, from a poverty-stricken population of 2,000,000; and it would be less than just to overlook the laborious care with which these founders of the Prussian state built up the material resources of the country. For

economy of administration, intelligence of industrial and agricultural development, for the husbanding and, when the time came, the expenditure of these resources for the expansion of Prussian power, it may be contended that the Prussian state of the eighteenth century was the most efficient in Europe. If the chief end of the state was power, here was its justification in the fact that the indispensable basis of power was the prosperity of the whole state. French absolutism without that fundamental guiding principle became selfish, debased and besotted, whereas Frederick the Great brought his little state to the highest point of military power in Europe; and even if Frederick in his younger days was the author of *Anti-Machiavel,* the Italian, it has been well said, would have forgiven the criticism to the conqueror of Silesia. It is necessary only to remind you of that masterpiece of Frederick's policy, to emphasize Treitschke's dictum that 'it is the highest moral duty of the state to safeguard its power.' Despite the guarantee of Austrian integrity both in the Pragmatic Sanction avowed by his father, and in pledges spontaneously renewed by himself, Frederick the Great, without a declaration of war, led his army into Silesia and robbed Maria Theresa whom Prussia had vowed to protect, of one of her richest provinces. What was seized by force without scruple in 1740 was defended during the Seven Years' War with such resolution and resourcefulness that the original violation of Silesia seems veritably to have been buried out of sight by German valour and sanctified by German blood. If Bismarck taught Treitschke, and Treitschke taught the Prussian bureaucracy, 'the Great King' himself may be said to have taught Bismarck.

Now I do not wish to trace Prussian history in a hostile spirit, or to suggest that it represents a sinister and unbroken tradition of force and diabolical evil. Quite the reverse in fact; for if the conception of the national state which one finds in Frederick the Great and in Bismarck and in Treitschke be accepted, the rest is merely a matter of *Real-politik*—of looking truth in the face. 'He who is not man enough,' says Treitschke, 'to look this truth in the face should not meddle in politics.' But even in Prussia—certainly in many another state in the present German confederation—there is to be traced a searching conflict of soul as the process of Prussianizing Germany proceeded with blood and iron. After the sinister conquest of Silesia, after that other masterpiece of Frederick the Great, the first partition of Poland in 1772, which has been called 'the most cynical crime of modern history,' there is visible a revolt against the Prussian juggernaut. After the humiliation of Jena

especially, when it seemed that the curse of God had rested upon the shallow fraud of the early Prussion policy with Napoleon, there arose during those wonderful years of liberation from 1807 to 1815 a new Prussia which even this devastating war can never stamp out of the pages of British history. In long varied contrast to the old Prussian tradition of violence and cynicism are enrolled names that may well be immortal; German but more than German; men of all countries and of all ages. And how many were Prussians of the Prussian school? Even Hardenburg, whose aims in foreign policy seem to have been German rather than Prussian, was like Scharnhorst a native of Hanover of the Georges. Stein, champion of freedom and of the splendours of intellectual Germany, was born near the Rhine, in Nassau, compatriot of William III. And what of the immortal name of Goethe, and of Fichte, and of Kant (Königsberger as he was) who wrote of *Perpetual Peace,* and of Dahlmann, and of Schiller? And when the struggling forces of liberal thought, in spite of the repressive forces in Prussia, asserted themselves in 1848, what hopes were not stirred across the English Channel— and across the Atlantic—at that gathering of a parliament for all Germany at Frankfort to draw up a scheme of German union on principles of freedom and liberty? The failure of that attempt, it seems to me, was the tragedy of German history; for the house, exorcised of one evil spirit, was left swept and garnished for seven other spirits more wicked than himself; and they entered in and dwelt there, and the last state of that house was worse than the first. The Germany of the idealist had failed; the Germany of 'blood and iron' began to rise in the titanic figure of Bismarck, and the very embers, it almost seems, of idealism and of liberal thought were quenched—quenched not so much in blood as in the heady intoxicating vintage of unbroken success.

It is not necessary to retrace the story of the last generation, to remind you of the Ems telegram and the Benedetti conversations of Bismarck, or of the 'scrap of paper' incident of Chancellor von Bethmann-Hollweg. And all this is not to beg the question nor to brand the Prussian policy as Machiavellian, as that term is usually mis-applied; but rather to suggest that if Treitschke's theory of the Prussian state be accepted, the wisdom of war, the right of renouncing treaties if these conflict with the interests of the state, the use of 'frightfulness' as a policy, all follow as corollaries (as Machiavelli would say) in the essential verity of the thing; and in this respect it may be said that the Prussian policy of state ('foreign policy' as distinct of course from internal and municipal government) em-

bodies the wisdom of 'enlightened absolutism' from Machiavelli to Bismarck and Chancellor von Bethmann-Hollweg. The Prussian sees in his history the unification of Germany emerging not from the springs of nature but from the fiery crucible of an imperial alchemist.

It must not be lost to sight, then, that Machiavelli outlined only the beginning of the system—a system not of the individual but of the state, and therefore, in his view, unmoral rather than immoral. In practise the slow moralization of the system was inevitable. It was not found to *pay* for ambassadors to plot against a monarch's life or for armies to poison wells. Thus Treitschke sees in modern Germany the absolutism of Machiavelli rectified by an enduring and lofty national purpose. Machiavelli was sound, says Treitschke, in his analysis of state and power, but 'this power itself has for him no content.' Machiavelli tells his 'prince' how power is to be attained: he does not tell his 'prince' how power is to be used. Herein lies the spell of Prussian imperialism. Treitschke's absolutism is enlightened, it is terribly efficient, and one may assume that all unnecessary conflict with standards of private morality—Machiavelli's 'terrible nakedness and hardness'—has been dispensed with. 'The power acquired must justify itself'; and that justification is to be found in the welding of scattered German states into a world power "filled with high aspirations in her nationality, her intellectual development, in her science, industries and trade." All this, it must be repeated, centers in the "enlightened absolutism" of the monarch. 'The mobilization of public opinion' is a phase of that absolutism. The universities are under imperial control; the press, to use Bismarck's phrase, is the 'ink-beast' of the autocrat. 'We are not,' says Bülow, 'a political people.' As a people, the Germans lack the 'art of doing the right thing politically, by a sure creative instinct.' 'No people is so little qualified' insists Bernhardi, 'to direct its own destinies, whether in parliamentarian or republican constitution. This conviction . . . is forced on us by a study of German history.' 'According to our constitution,' says Treitschke categorically, 'the monarch alone is vested with the power of the state,' and 'the essence of the state consists in this, that it can suffer no higher power above itself.'

One must go back in British history nearly three centuries to find a king or a statesman bold enough or autocratic enough to claim an irresponsible prerogative over the state. 'That which concerns the mystery of the king's power,' said James I in 1616, 'is not lawful to be disputed.' Not since the Stuarts has a British monarch

forbidden the House of Commons to 'presume henceforth to meddle with anything concerning our government or deep matters of state,' or to 'usurp our prerogative royal and meddle with things far above your reach.' Foundations, as you know, for our development were laid nearly four centuries before the Stuarts came to the throne and two centuries and a half before Machiavelli was born. I have already tried to suggest how Magna Carta determined once for all that the king (for instance) is and forever shall be under law; and how that contention was verified never more tragically in our history than in the revolution against the Stuarts. The king, as you know, is now 'sovereign in office but not in person.' The doctrine that the king can do no wrong is true for the best of reasons, that he has power to do nothing but by the advice and consent of his ministers who are directly responsible to the people.

Needless to say, however, the vindication of equitable law has not been directed solely or even chiefly against the king; and since that day our constitutional history has been a succession of movements—practical and prosaic in themselves—but directed steadily against prerogative wherever irresponsible privilege and 'man's inhumanity to man' have raised their heads. It would be idle to assume that this struggle has been uniformly successful or that it is not still going on. It has cost much in blood and treasure and it has taken forms without number. The royal prerogative of 'suspending of laws or the execution of laws' ceased at the Bill of Rights; the irresponsible prerogative of the crown over the judges was removed in 1700 by the Act of Settlement; prerogative in religion has been modified by the Toleration Act, by the disestablishment of the Irish Church, by Roman Catholic Emancipation; the prerogative claimed by Great Britain to tax and govern thirteen distant colonies led to the Revolutionary War; when the fundamental problem at the root of that great issue arose again on Canadian soil, a solution—this time a more peaceful one—was found by true British methods in the system of Responsible Government. The prerogative necessarily exercised over the crown colonies is even now giving way wherever it can safely be withdrawn. One finds the same great problem of prerogative slowly emerging in the Dominions with regard to the foreign policy of the British Empire. And not least of all there is—on our side of the Atlantic at least—the prerogative of the railway and the trust, that intangible spirit of privilege which is as dangerous perhaps as any that our race has ever confronted, because it is not all evil, and because it dissolves, like Proteus in the Greek myth, between the very groping fingers of the law. The

prerogative of a class or of an individual is easily disposed of; it would be safe to say, I think, that the prerogative of a corrupt electorate or a cynical predatory clique within the democracy itself, is of all prerogatives the most insidious and the most difficult to eradicate, because like the canker-worm, it feeds upon the vitals of the state which protects it. Fortunately the remedy, we believe, is as simple as it is efficacious. *Keep the springs pure.* One must acknowledge that under our system of government we get exactly the kind of administration we deserve; and if we suffer, the abuse directs us unmistakably to the root of the disease, the state of public morality. The advice of Polonius is as true of Canada in the twentieth century as it was of Laertes:

> To thine own self be true
> And it must follow as the night the day
> Thou can'st not then be false to any man.

After all, equity and justice between man and man, interest and interest, nation and nation, is the fundamental principle, I take it, of democracy.

All this then is perhaps another way of saying that we are moving towards justice—not the justice of 'enlightened absolutism' but the fundamental justice in the 'essential verity of the thing' which proceeds naturally from the very principles of liberty and democracy, in the deepest meaning of that much-abused word. In such a democracy the sense of justice, the law-abiding spirit of the people, finds as inevitable expression in the state as the irresponsibility of an emperor, the right of renouncing inconvenient treaties, the use of 'frightfulness' as a policy, find expression—if the occasion demands it—in Treitschke's theory of the Prussian state. And if the details of this war—the violation of the 'scrap of paper,' the execution of innocent hostages in Belgium, the use of submarines to sink defenceless ships, crews and passengers—indicate phases of the Prussion theory of power as 'the be-all and the end-all of the state' whose 'highest moral duty,' as Treitschke says, is at all costs 'to safeguard its power,' then these acts have come to mean very much more to us in Canada than the oppression of the weak and the shedding of innocent blood. The exponent of 'enlightened absolutism' may extenuate or excuse. We in Canada, believing as we do in our traditional democracy, are beginning to stand aghast at nothing less than one of the most appalling of moral cataclysms. To herself, a victorious Germany of Treitschke's thinking would justify herself; to other nations, even to 'enlightened absolutisms,' Treitschke's Germany would be a perpetual menace; to nations—

to the British Dominions—that have been cradled and nurtured in the spirit of democracy, Treitschke's Prussian 'state,' whether victorious or vanquished, seems to be beyond the pale of international obligations and athwart the greatest movement, we feel, of our civilization—the movement which is founded upon the belief that peace is as noble as war; that the sanctity of treaties is to the state what the plighted word is to the man of honour; that no national prerogative either of culture or of military power should override the dictates of simple justice among men and among nations.

Now the only suggestions that can be added must be few and fragmentary. What does all this mean for the teaching of history? The incompatibility of Treitschke's state with its 'essential verities' and democracy with its 'essential verities' seems to us to be fundamental. This war we feel, is a conflict between what is best in our history and what the Prussian schoolmaster of Germany insists is the best in theirs. It is said that Gladstone could never be induced, even in Morley's intimate friendship, so much as to discuss Machiavelli. But one must try above all things to be just. Our own foreign policy has been at times cynical, unscrupulous and tortuous; if this is true, we believe that it has been so not because of democracy but in spite of it. We believe that the hope of the world lies not in the 'prerogative of German culture'—Bernhardi's own phrase—but in the spread of justice among men and among the nations; and (if one pauses to think) justice necessarily demands the spread of truth. To pervert history even to prove our own cause is as immoral as the prostration of history by the Prussian school before the Prussian state. To paraphrase Treitschke himself, he who is not man enough to look this truth in the face ought to keep his hands off history. Courage less than this must lead in the long run to that disenthronement which, as Ramsay Muir has finely said, 'inevitably comes to all who work at history to prove a case, or to serve a cause, or for any reason other than the love of truth.'

Two other fragmentary suggestions may be made. What is our hope for 'our friend the enemy'? This, it must be emphasized, is the war of Imperial Germany, of 'the monarch' as Treitschke says, who 'alone . . . according to our constitution . . . is vested with the power of the state.' That the German people are fighting in a body with magnificent enthusiasm is undoubted. It was Bismarck who 'mobilized public opinion' into an 'orchestra which obeys only the baton of government.' But in a single sentence Bernhardi himself has blundered into a profound truth which contains within itself, it seems to me, a suggestion of great possibilities.

'Success,' he says, 'was the foundation on which Bismarck built up the mighty fabric of the German Empire.' Bismarck's subtlety and adroitness in justifying the Danish, the Austrian and the Franco-Prussian wars to the people of Germany by the dazzling spell of uniform success requires no elaboration here. What if Germany fails, as we believe she must fail, in this war? Will the German people, cradled in the same surly independence and primitive democratic aptitudes which Tacitus ascribes to them in common with our own Anglo-Saxon ancestors, accept forever the dictum of Prince von Bülow that they are incapable as a people of 'doing the right thing politically?'

And what of our own future? Is it too much to say that the Prussian state at its best presents the highest phase of 'enlightened absolutism' known to history? Even so, the faith that is in us replies that the system as such has now run its course from worst to best, and must pass away; while democracy is only in the first stage of its development. In the 'essential verities of the thing' the truly democratic state must reflect the intellectual and moral progress of the individuals who comprise it; and with progress, the wider rule of equitable law and justice among the nations is as inevitable as the assimilation of discordant and conflicting elements in a single democratic state. We believe that already our foreign policy is becoming truly democratized; Sir Edward Grey's diplomacy is the verdict of the cabinet and will stand in the next election at the bar of public opinion. We recognize on the other hand that democracies in the mass are not always the best judges of peace and war in great crises. It would be safe, I believe, to say that even the century of peace between the United States and the British Empire—an object lesson for all time in enlightened democracy—would scarcely have been possible on at least one or two occasions without the steady restraint and rugged moral courage of Lord Lyons and Abraham Lincoln. Our safeguard lies in the fact that foreign policy is placed in the hands of a directly representative and responsible cabinet which can never become a permanent, oligarchical clique. Above all we believe that in the process of human development we face the rising and not the setting sun. Absolutism, however enlightened in one generation, holds no guarantee for the next. The arms may be of iron but the feet are of clay,

> While self-dependent power can time defy
> As rocks resist the billows and the sky.

Some Debt Histories of North Dakota Cities

JAMES E. BOYLE,

Professor of Economics and Political Science, University of North Dakota

I

INTRODUCTORY

PUBLIC Finance is now coming to be one of the most pressing of our economic problems. In this particular field we are far behind the most backward countries of Europe. The Budget, for instance, long established on a scientific basis in Russia, is still entirely unused in our federal, state, and local financial legislation. It is true that within the last few years a small number of our commonwealths, such as Oregon and New York, are making use of a real Budget. But our record in this respect is one, one the whole, of which we ought to be truly ashamed.

City finances are now claiming attention as never before, due chiefly to the rapid increase in functions of the American city. But city budgetary matters are no further advanced than are those of our commonwealths or of our national government. The following study covers a few of the cities in the new State of North Dakota. The evidence here presented shows the striking tendencies, not only in North Dakota but in nearly all our American cities, namely, the quickness—almost recklessness—with which cities rush into debt, and the slowness with which they pay these debts. One surprising thing is that the city's credit remains good and that plenty of funds are consequently forthcoming at the rate of interest commonly as low as four per cent.

In North Dakota cities, we find that about one-third of the taxes paid by the local tax payers are for city purposes, one-third for school purposes, and the other third is divided between the State and the county.

II

REFUNDING POLICY

Section 184 of the North Dakota Constitution contains this sole reference to the policy of refunding public debt:

"Any city, county, township, school district or any other political subdivision incurring indebtedness shall at or before the time of so doing, provide for the collection of an annual tax sufficient

to pay the interest and also the principal thereof when due, and all laws or ordinances providing for the payment of the interest or principal of any debt shall be irrepealable until such debt be paid."

The reader must construe these words for himself. Whether or not these words intend to prohibit refunding, refunding is very generally practised by the cities. Debt histories of actual cities will now be tabulated in convenient form for study and comparison.

III

Debt Statistics

The following tables give the statistics from date of incorporation to January 1915, for the respective cities:

DEBT HISTORY OF THE CITY OF GRAND FORKS, NORTH DAKOTA

No.	Amt	Rate	Issued Due	Purpose	History
1	$ 5,000	7	1881—1896	Build City Hall	Paid when due
2	24,000	7	1882—1897	Street Improvements	$12,000 paid when due; $12,000 refunded, No. 10
3	15,000	7	1882—1897	Waterworks	$2,000 paid when due; $13,000 refunded No. 10
4	6,000	7	1882—1897	Fire Apparatus etc	$1,000 paid when due; $5,000 refunded, No. 10
5	15,000	7	1884—1899	Waterworks Extension	Refunded, No. 11
6	18,000	7	1885—1905	Waterworks Funding Bonds	Paid when due
7	50,000	7	1889—1909	Bridge	$10,000 paid when due; $40,000 refunded, No. 14
8	51,000	6	1890—1910	Fund Floating Debt	$6,000 paid when due; $45,000 refunded, No. 18
9	40,000	6	1894—1914	Filter Plant	Refunded, No. 21
10	30,000	6	1897—1917	Refunding Nos. 2, 3, 4	
11	15,000	5½	1899—1919	Refunding No. 5	
12	50,000	4½	1905—1925	Fund Floating Debt (Water, $33-000); (Interest $17,000.)	
13	14,000	4	1906—1926	Water Main Extension	
14	40,000	4	1909—1929	Refunding No. 7	
15	69,000	4	1910—1930	Street Improvements	
16	23,000	4	1910—1930	Power and Light Plant	
17	33,000	4	1910—1930	Water Improvements	
18	45,000	4	1910—1930	Refunding Funded Floating Debt, No. 8	
19	40,000	4	1911—Serially 1922-1931	City Hall	
20	12,000	4	1913—Serially 1924-1933	Municipal Slaughter House	
21	40,000	4	1914—Serially 1920-1934	Refunding No. 9	

Total Outstanding Debt, Jan. 1, 1915, $411,000

DEBT HISTORY, CITY OF FARGO, NORTH DAKOTA

No.	Amt	Rate	Issued Due	Purpose	History
1	$ 5,000	7	1880—1896	Waterworks	Paid
2	10,000	7	1880—1901	Waterworks	Paid
3	10,000	7	1880—1906	Waterworks	Paid
4	20,000	7	1880—1911	Waterworks	Paid
5	7,000	7	1880—1901	Fund Floating Debt (water)	Paid
6	9,000	7	1881—1901	Streets	Paid
7	34,000	7	1881—1901	Fund Floating Debt	
8	7,000	7	1881—1901	Fund Floating Debt	Paid
9	8,000	7	1882—1902	Sewer	Paid
10	37,000	8	1883—1893	Fund Floating Debt	Paid $12,000 paid; $25,000 refunded No. 16
11	15,000	7	1883—1903	Sewer	Paid
12	20,000	7	1883—1903	Bridge	Paid
13	4,000	7	1883—1903	Bridge	Paid
14	9,000	7	1884—1904	Bridge	Refunded No. 18
15	40,000	6	1891—1911	Waterworks	Paid
16	25,000	6	1893—1913	Refunding No. 10	Refunded No. 28
17	30,000	6	1895—1915	Water and Sewer	
18	9,000	5	1904—1924	Refunding No. 14	
19	5,000	5	1910—1915	Hospital	
20	5,000	5	1910—1920	Hospital	
21	5,000	5	1910—1925	Hospital	
22	15,000	5	1911—1916	Waterworks Plant	
23	15,000	5	1911—1921	Waterworks Plant	
24	15,000	5	1911—1926	Waterworks Plant	
25	20,000	5	1911—1931	Waterworks Plant	
26	10,000	5	1912—1927	Electric Light Plant	
27	57,341	4	1913—1933	Refund Floaing Debt (water)	
28	25,000	4	1913—1933	Refunding No. 16	
29	100,000	4	1914—1934	Fund Floating Debt	

Total Outstanding Debt, Jan. 1, 1915, $311,341

DEBT HISTORY, CITY OF DEVILS LAKE, NORTH DAKOTA

No.	Amt	Rate	Issued Due	Purpose	History
1	$ 5,000	8	1884—1899	Fire Department	Paid
2	12,000	7	1888—1908	Artesian well and City Hall	Refunded, No 4
3	6,500	5	1906—Serially 1911—1923	Bridge	Paid serially (all paid 1912)
4	12,000	5½	1908—1918	Refunding No. 2	
5	10,000	5	1911—1931	Fire Hall	
6	38,000	4	1913—1933	Fund Floating Debt	
7	4,000	5½	1914—1924	Street Lights	

Total Outstanding Debt, Jan. 1, 1915, $64,000

DEBT HISTORY, CITY OF MINOT, NORTH DAKOTA

No.	Amt	Rate	Issued Due	Purpose	History
1	$ 8,000	7	1894—1904	Waterworks	Refunded, No. 3
2	8,000	6	1896—1911	Refund Floating Debt	Paid
3	8,000	5	1904—1924	Refunding No 1	Sinking fund on hand to meet debt
4	30,000	6	1908—1924	Waterworks Extension	Sinking fund on hand to meet debt
5	115,000	4	1909—1929	Fund Floating Debt	Sinking fund on hand to meet debt

Total Outstanding Debt, Jan. 1, 1915, $153,000. Offset by sinking fund providing for amortization when due

The four cities named above had the following populations in 1910:

Grand Forks	12,478
Fargo	14,331
Devils Lake	5,157
Minot	6,188

The first city named above has the mayor and council form of government. The other three, Fargo, Devils Lake, and Minot, have all adopted the Commission plan. Each of these three cities, upon changing over to the Commission form, was confronted by a heavy floating debt, which was, in each case, changed into a funded debt.

Perhaps the most striking showing made by these statistics, and the one lesson of real significance, is the complete failure of the Sinking Fund system, and the absolute necessity of the Serial plan of retiring a bond issue. A new administration, coming into power, is under pressure to lower the tax rate. How can this be done? When all other methods fail, there is the sinking fund. If a small sinking fund has been created, turn it into the general fund, and omit further levy for the sinking fund. This method actually lowers the tax levy (even in the face of increased expenditures), and postpones to some future administration the problem of paying the debt then due—or refunding it.

The Relation of Fraternities to the University

EDWARD BEATTIE STEPHENSON,

Assistant Professor of Physics, University of North Dakota

WHEN you see a man wearing a Greek letter fraternity pin, what do you think? Your mental reaction probably depends on your point of view and your previous experience, but at least you know that the wearer has been to college and that for some reason he was a member of a particular group. It is this idea of belonging to a particular group that has been the basis for the organization of the fraternity system in our colleges and universities. Fundamentally it is the tribal instinct of the primitive man, the gang spirit of the growing boy, the club spirit of the mature man. In the very primitiveness and universality of this instinct lies the strength of the fraternity system and the reason for its development.

The growth of fraternities has been coincident with that of the colleges.[1] Beginning as early as 1776, they were well established by 1850, suffered a relapse during the civil war, especially in the South, were well revived by 1870, had a steady growth for the next thirty years in spite of considerable faculty opposition, and in the last fifteen years have increased enormously. Here is a system within the universities that includes at least two thousand five hundred active organizations, that has approximately half a million active and alumni members, that owns some $15,000,000 worth of property,[2] and yet fraternities are frequently not even mentioned in the university catalogs. One reason for such an anomalous condition is that the public or the university authorities have not always found the fraternities to be an unmixed good and have frequently imposed restrictions that seemed unduly harsh to the fraternities with a consequent lack of appreciation on both sides. There are many indications at present of a change in point of view of both the university and the fraternities.

It is the purpose of this article to discuss some of the essential conditions which exist in a successful fraternity, to consider some of the official relations that exist between the university and the fraternities, and to suggest in each case some ways in which they can co-operate in working for their common good. It is not purposed

1. For a detailed history and data concerning each fraternity, see Baird's American College Fraternities, 1912 edition.
2. Estimated from Baird's Manual.

to write a defense of or argument for fraternities, but to outline some constructive policies for both the fraternities and the university.

Essential Conditions in a Successful Fraternity[3]

A college or university is an educational institution and must maintain certain standards of scholarship. A fraternity being an organization within the university must help maintain these standards. It is possibly true that, in the past generation of the old-fashioned college with its narrow classical curriculum and wide separation from every day life, many men who were naturally or willfully very poor students in college afterwards became successful business or even professional men, but in the present generation where the university course is more technical or professional, and specialization begins early and is carried far, common sense shows and abundant statistics prove[4] that the good student has the greatest chance of success in life. It is not argued that it is essential or even desirable for a social fraternity that all its members should be honor students, but it is maintained that the scholarship average of the fraternity should be above the average of the university as a whole.

A fraternity man is a picked man, chosen from the crowd because he has or is expected to develop those qualities that will make him a positive addition to that particular group. He should be at least an average student and something more, and under these conditions the fraternities will naturally have more than their pro rata share of the leaders in the varied college activities, because it is the fact or promise of this leadership that frequently results in a man being asked to join a fraternity. It is a tendency towards low scholarship on the part of the fraternities that has been one of the strongest grounds for faculty objection to the system, and it seems very reasonable that if the fraternities were generally and consistently to maintain a scholarship average better than that of the university as a whole, not only would this objection be removed but most of the others would vanish with it. Good scholarship and most of the evils of fraternity life are mutually exclusive. That this is recognized as an important point is shown by the efforts of many of the national fraternity officers and publications to emphasize it.[5]

3. The word fraternity as here used is limited to undergraduate social fraternities, but includes sororities.

4. A study of the record of the graduates from five important eastern universities covering a period of approximately twenty years shows that of the first honor men nearly fifty per cent are mentioned in Who's Who, of the second honor men about twenty-five per cent., and of the pass men some five per cent. In other words the first honor men have about ten chances to one over the pass men of achieving that distinction. Van Dyke, Scribner's (Sept., 1912); Davies, Quarterly Journal (Apr., 1914).

5. See almost any number of any national fraternity journal, e.g. The Scroll of Phi Delta Theta v. 37, pp. 365, 481, 1912-13.

The undergraduate fraternity is primarily a social organization, that is, its chief benefits come from the association of congenial friends, but intimate friendships are necessarily limited in number and require a considerable period for their development. A group of men of common tastes, electing new members by unanimous vote, living together in intimate daily companionship in a chapter house owned by the fraternity and its alumni, certainly furnishes the best conditions for the development of strong friendships. To make these friendships worth while, however, requires that they be between strong all-round men, and this in turn implies that the men of a successful fraternity should take part in the various college activities —literary, athletic, dramatic, and political. Each fraternity should try to excel in some one or more of these lines of activity and should have some good men in each, but too great a concentration in any one direction, tho possibly a source of temporary strength, is ultimately fatal to symmetrical development. A fraternity composed entirely of athletes is as hopelessly one-sided as a fraternity "all grinds." The same principle applies in the geographical and departmental distribution of members. With this idea of the fullest all round development in mind, it is not a wise policy for a fraternity to have too many men from any one town or in any one department of the university, for it is by contact with men of varied interests that one gets the fullest development.

College politics offers an attractive field for every normal student, and with the educational advantages he has, he should be setting the standards for the generation of citizens he is ambitious to lead. It is perfectly proper too that fraternities should be actively interested in politics where their picked men and strong organization give them great power, but with this power comes the responsibility for its correct usage. How unfortunate then when college politics degenerates into a petty squabble between rival fraternities, and the devious methods of the political boss and the ward heeler hold full sway. This condition will not be remedied by trying to keep fraternities out of politics, but by making them feel the responsibility of putting up men who can do the best for the university. There may be momentary pride in boasting that a fraternity brother holds a certain office, but a poor man elected to office by political trickery is sure to fail, to the lasting discredit of his fraternity. The idea that the good of the university comes first must always be dominant, and ultimately it will work for the good of the fraternity, for the modern test of greatness is the amount of service well performed.

The support of any active organization costs money and the op-

portunity for extra social activities is generally greater so that, other things being equal, the expenses of the fraternity man will be greater than those of the non-fraternity man. In one institution with which the writer is personally familiar it was found that the normal expenses of the fraternity men were from ten per cent to thirty per cent greater than those of the non-fraternity men. The individual must personally determine whether the advantages are worth the additional cost. A few hundred dollars may be a paltry price for some to pay for the opportunity of forming a few life-long friendships, while for others the same amount squandered in frivolous society may be a ruthless extravagance. The wise policy is for each fraternity, and for all the fraternities in co-operation, to endeavor to keep expenses on a normal basis as determined by local university standards of living.

As in politics so in society, the college student tends to emulate the activities of his parents or of the leaders in the community and, with some allowance for youthful extravagance, the social life of the fraternity will not differ much from that of the community at large. The evils are common to society in general and not inherent in the fraternities. A reasonable number of parties, dances, smokers, etc., is a part of the training of a well rounded college man, but undue extravagance in this line soon restricts fraternity membership to those who can afford the expense and results in the very one-sidedness that the social life is intended to overcome. Experience has shown that by faculty rules or more preferably by mutual agreement the fraternities can limit their social affairs in number and expense in a perfectly satisfactory manner.

Probably the most common objection to the fraternity system is its undemocratic tendencies. To many the idea of exclusiveness is highly desirable and they are responsible for the abnormal development of this tendency which to a certain extent is inherent in all fraternities. Of course it might be argued that human nature is not particularly democratic anyway and that extreme democracy is usually limited to politicians just before election time, but it will probably be granted that the man who goes thru college and knows only the men of his own fraternity is not doing the best for himself or his school. In the western institutions, at any rate, such a policy carries its own remedy, for unless a fraternity keeps in constant touch with the new men it misses the best ones and will soon automatically eliminate itself from any position of importance.

One of the most promising steps in the right direction has been

taken in a number of institutions rather recently in an organization by all the fraternities of a Pan-Hellenic or Inter-fraternity Council. Such an organization is to the fraternities what the commercial club is to the business men of a modern city. It is a recognition of their community of interests, that their main problems are common to all, and that by united action many things are possible that are practically impossible for an individual. It used to be assumed that one fraternity could succeed only at the expense of some other, when as a matter of fact the best method for a fraternity permanently to maintain an advanced position is to help all the others maintain the same position, just as the modern grocery store is helped by a prosperous hardware store on the opposite corner even if their lines overlap in places. One fraternity at an institution may easily injure the reputation of all because the general public is quite unable to distinguish the difference between Alpha Beta Gamma and Gamma Beta Alpha and superficially reasons that the errors of one individual of one fraternity are common to all members of all fraternities. A well organized inter-fraternity council may accomplish much in bringing all the fraternities up to accepted standards, and is an efficient means for regulating the social and political life.

The council as a medium for the consideration of fraternity problems with the faculty will be discust in the next section.

Official Relations of the University and the Fraternities

In the first place there must be recognized the fact of the existence of fraternities in nearly all colleges and universities, the fact that these organizations have many members and control much property, and the fact that the fraternity ideal appeals to a very fundamental and very human instinct—the desire to belong to a particular group—and experience has shown that this instinct is stronger than any respect for faculty rule or academic theories of democracy. Having unsuccessfully tried ignoring fraternities, or more or less rigidly suppressing them, the logical thing would seem to be a frank recognition of them as responsible organizations and an attempt thru cooperation to guide their valuable energies in the right direction.

The official dealings of the university with the fraternities may well be thru a faculty committee composed of men who are interested in fraternities, tho not necessarily all fraternity men, and who still retain some recollection of the fraternity student point of view. On the wisdom, enthusiasm, and personal influence of this committee and not on any system of rules and regulations, however elaborate and comprehensive these may be, will the success of the system depend.

The committee should establish and maintain some definite policy, should state this policy in a few general principles, and make an annual effort to educate the fraternities up to the spirit and letter of these principles. One of the most general principles is that the permanent interests of the individual, of the fraternities, and of the university are identical, but if a temporary or apparent conflict arises the highest loyalty demands that we serve the bigger and better institution. If the fraternities and the faculties really believe this, the solution of any problem is a matter of getting together and working out the details on the basis of a common interest in the university. The faculty committee thus meets the fraternities in a spirit of co-operation, and with many questions there are advantages in dealing officially with the inter-fraternity council because this method emphasizes the common interests of the fraternities and the responsibility of all for each one.

The faculty by co-operation with the fraternity as an organization has an effective means of raising the standard of scholarship. A student may feel as an individual that he has a right to do largely as he pleases, but as a member of an organization he feels it his duty to maintain the standards of the organization, and his loyalty to it is stronger than his personal interests. A scholarship report therefore to the officers of a fraternity may be more effective than a direct appeal to the individual, especially where the officers are in a position to see that their suggestions are carried out. This of course presupposes a desire on the part of the fraternity as a whole to maintain a satisfactory scholarship standard. If the fraternities at an institution are ranked according to scholarship and compared with the average of the university as a whole, the resulting rivalry is a strong incentive towards good work.[6] More important than any such incentive is that people should really believe that the good student in college is the one who makes good in after life. That this is a fact can easily be demonstrated but it needs constant emphasis and reiteration.

It is pretty generally agreed that the more fully student self-government can be realized in an institution, the better for students and faculty, but any such system must arise by a process of growth and be inaugurated on the demand of the students, for if imposed by the faculty without an educated public sentiment among the students it is very liable to become a farce. Where self-government is not

6. The fraternities of the University of North Dakota have shown a marked increase in scholarship since this system was inaugurated, and at present the fraternity average for both men and women is above the non-fraternity average and above that of the university as a whole.

already in force, the inter-fraternity council may afford a beginning in that line, in the training of leaders and in the development of the idea that the student interests and the faculty interests are common. Each chapter now has a limited self-government of the personal conduct of its members, and this idea might easily be extended to cover most matters of university discipline. The inter-fraternity council would act like a student court under any self-government system and consider matters of discipline of fraternity men. (Obviously they would have no power over non-fraternity men.) The privilege of representation in the court could be extended to any responsible organization whether a fraternity or not, and if the plan worked to advantage the student body as a whole would soon be anxious to adopt it. It would then be easy to reorganize on a basis that would include the whole university, and there would be men trained as leaders and a considerable body of students that were accustomed to the system to carry it thru the initial period.[7]

The chapter house system offers a solution of the housing problem that has many points in its favor. It is analogous to the college system in the great universities in England or to the cottage system adopted in some American institutions. The small group of the chapter house with the sleeping quarters, chapter rooms and dining hall all in one building more nearly approximates home life, and personal responsibility for and pride in the house eliminate much of the "rough housing" so common in the large dormitory or private boarding houses. The chapter house is usually owned or being purchased by the active chapter and the alumni at considerable personal effort and sacrifice and this gives them a material as well as a sentimental interest in the fraternity for all time. Also it relieves the university of the financial burden of providing quarters for a large proportion of the students. In some institutions fully half the buildings are used for dormitories and this investment might easily be released for increasing the facilities of the school. To encourage the building of chapter houses it may be feasible for the university to donate or lease locations on the campus and from its endowment fund make long term loans on the buildings. The members of the fraternities, however, should have the same freedom that they would in a house off

7. The self-government plan here outlined would have to be adapted to local conditions where introduced. The obvious objection of favoritism towards fraternities is in reality without weight because self-government throws an added responsibility upon the student, and experience has shown that student courts tend to be much more severe in discipline than the faculty. As long as the system is open to any responsible organization, or to the whole university, on request, a student who refuses to ally himself with any organization has no valid complaint.

the campus. This system is in successful operation at a number of places.[8]

In some institutions, either by faculty rule or by fraternity agreement, a man is not eligible to membership in a fraternity until his sophomore year and may not even be pledged until the second semester of his freshman year. The theory of this system is that for his first year a man is a member of the whole university, he has a chance to get acquainted with all his classmates, to learn the traditions of the university and fully to orient himself before he unites with any particular group. When he does join a fraternity he does so with the fullest mutual knowledge on the part of the fraternity and himself and this is to the advantage of both. Experience has fully demonstrated that under the changed environment of college a man does not necessarily follow his home or high school record, and if pledged on this record alone may not develop as anticipated. If a student returns for his sophomore year it is evidence that he made at least a passing record and that he has some seriousness of purpose. If initiated then he has potential value, but if initiated in his freshman year and he does not return, he is usually a dead load on the fraternity. It is pretty generally true that a man's value to a fraternity increases in proportion to his age and experience in its affairs. The opportunity for the fullest knowledge on the part of the fraternity and on the part of the candidate is certainly desirable, for it is only when a man is in the fraternity that most nearly meets his ideals that he will have his own fullest development or can work for the best interests of the fraternity.

There is another system of pledging and initiation based on a very different theory. It is to acquire full information of a man's family and record before he comes to college, pledge him immediately on entrance in the belief that he will maintain his previous record in the proper environment, take him into the fraternity house where he can be under the supervision of the older men and taught the proper habits and ideals, and then initiate him after a brief probation. When a large chapter house is maintained it requires a correspondingly large chapter and it is an advantage to be able to fill the house with fresh-

8. For example:—In 1912 the University of Alabama required that all fraternity houses not already there be established on the campus, offered a 99-year lease at a nominal rental of $10 per year on a site and proposed to loan 60% of the value of the house at 6% interest.

In one college where the dormitories were being abandoned by the better students on account of the lack of discipline, the problem was solved by dividing each building into separate units with large living and chapter rooms as well as bed rooms and leasing each unit to a fraternity at the same rental the men would have paid for the bed rooms. The more homelike conditions and the localization of responsibility eliminated the difficulties of discipline and kept the dormitories full.

men when necessary. This system would undoubtedly work admirably with the ideal fraternity, but it is a correspondingly bad failure with a weak or poor one. Its chief objection is that early pledging does not give either the fraternity or the pledged man an opportunity to acquire full information, and the consensus of opinion among progressive fraternities seems to be against it.

The very essence of fraternity life is a feeling of loyalty to the group and a high spirit of honor among members. A man trained in fraternity ideals should be the first to get a vision of a larger group, his university, and should have the same feeling of loyalty to her and the same high spirit of honor among all her members, both students and faculty. That more do not get this vision is partly a matter of habit and partly of tradition. Brought up under the authoritative and disciplinary methods of the grade schools, the student carries these ideas with him to the university, expects to be told what to do and what to study and then to be made to do it, so that at the end of four years he may be graduated with an academic degree. It is often late in his course, if at all, that he gets the idea that a university is a place where a man comes to work together with older students, the faculty, on problems of common interest. If he could only get some such idea earlier he would have a real "college spirit." Now college spirit in athletics is a matter of education, as any one well knows who has organized a few mass meetings, and so is this bigger college spirit. With Mark Hopkins on one end of a log and a student on the other there was no question of college spirit in that university, but under present conditions the student must be taught his ideals of loyalty and of honor—of true college spirit. The faculty is as truly interested in this as in the teaching of Latin or Physics, but other students are the chief educators. Because of the close companionship and the continuity of the organizations, the fraternities have a peculiar advantage in the handing down of traditions and ideals of college spirit, and ultimately they must accept a large share of the responsibility for the standards maintained. There is no real reason why a student should not become as much interested in seeing his fraternity stand at the head of all that is best in college life as he is in seeing his college team win an inter-collegiate championship, if he should once get interested in the former game. There is no real reason why a student is more justified in cribbing in an examination than in forging a check at the bank. The engineer who builds a bridge that collapses because he cribbed thru his course in strength of materials and the doctor who has a fatal operation because he cribbed thru his course in anatomy realize this too late, but

a strong fraternity tradition that demand the same standard of honor in the class room, on the athletic field, and among all men will do much to establish a true college spirit that will make any other standard of honor untenable.

When possible to have them, two or three patrons or advisors (probably not more) chosen from resident faculty or alumni may be of immense value to the fraternity in maintaining its traditions and carrying out its permanent policies. They have the advantage of working as individuals without the restraints of official faculty connection, but they must have an enthusiasm well tempered with wisdom and a feeling of responsibility for their position. Their influence like that of the faculty committee on fraternities must be guiding and directing and not dominating, because such outside dominance removes from the fraternity the feeling of responsibility so necessary for its proper development.

Finally, if fraternities are really a good thing, of permanent value to the members, and if all the fraternities are working together for the good of the university, the logical conclusion is that the system should be so developed that everyone at all congenial may have the opportunity of belonging to a fraternity and sharing in its benefits. It would then no longer be undemocratic to belong to a fraternity, and a wise and constructive policy, made possible of execution thru the system of organization, would carry the whole student body onward to the highest standards of honor, morality and scholarship.

Conclusion

In conclusion may we say that thruout this article we have emphasized the spirit and point of view rather than details of administration. Any problem approached in the right spirit and with a clear understanding of the essential principles involved is capable of general solution. The details depend on local conditions. The idea that the greater good of the university must always come first is fundamentally true and makes a strong appeal to every normal student and faculty man. It should be the standard by which every proposition is mesured. Some of the suggestions made are frankly ideal, but we must have ideals towards which we may strive if we are to progress intelligently. May we then sketch briefly an ideal fraternity and its relation to the university.

The ideal fraternity is composed of students who are at an educational institution for the purpose of acquiring an education. These students live together on terms of intimate friendship with others

of congenial tastes, take an interest in society and in varied college activities, have a college spirit that demands the same standard of honor in the class room, on the athletic field, and among all men, and are broad enough to co-operate with the other fraternities in working for the best interests of the university. The university, recognizing the strength of the fraternity idea, is interested in directing its energies in the right way. This directing influence comes thru the personal efforts of the faculty rather than thru an elaborate system of rules and regulations. The encouragement of the chapter house system and an inter-fraternity council are in the direction of student self-government and when the fraternity system is working properly it should be so extended that all the students may share its benefits.[9]

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9. After this article was written there appeared an article in "Science" vol. 40, pp. 542-547, Oct. 16, 1914, on Fraternities and Scholarship at the University of Illinois that was based on the records of 25 national social fraternities, 700 fraternity men, and a total of 2,600 fraternity and non-fraternity men, and covered a period of 10 semesters from 1909 to 1914. Statistics of such a large group over such a period of time furnish a safe basis for conclusions, and it is interesting to note the corroboration of a number of points made above.

The curves show that before the publication of fraternity rankings the fraternities maintained a fairly constant average about 2½% (on the basis of 100%) below the university average, that during the two semesters following the publication of the rankings there was a permanent gain of over 1%, which was followed by a further permanent gain due to the adoption of a rule requiring that freshman establish 11 credits before initiation, and now the fraternity average is less than ½% below the university average and seems to be gaining steadily. A study of the courses of individual fraternities shows that "high averages or low depend on the presence or absence of a masterful leader" and that the one factor preeminently valuable is chapter management. That a man's value to a fraternity depends on his length of service in the fraternity is shown by a comparison of four fraternities otherwise similar but differing widely in scholarship, where the scholarship ranking is in close agreement with the percentage of initiates who graduated. The common explanation that fraternity scholarship is low because the men do more outside work is held improbable because the "loafer in the class room is usually a loafer outside." The evidence is clear that fraternity upperclassmen are content with a grade of work somewhat below that of which they are capable. This is a serious charge and can be met only by the fraternities bringing their average up to the university average.

Some Facts Concerning the Germans of North Dakota

William Godfrey Bek,

Professor of the German Language and Literature, University of North Dakota

THE opportunites for cultural historical studies are singularly rich in North Dakota. Indian lore is still to be had at first hand and pioneer life can be observed by even the most superficial onlooker. A powerful foreign element, mostly from the industrious northern countries of Europe, is crystalizing into American citizenship before our very eyes. The causes and motives that prompted the coming of the various elements are readily discernable. The very footprints of the pioneers who blazed the way for their kin, whether they came by way of the Missouri, or by way of the Red River of the North, over the trail or by rail, can be traced with comparative ease and reasonable accuracy.

North Dakota is a young state, only twenty-six years old, and shows all the enthusiasm and vim which are prerogatives of youth. In 1870 its vast area of 70,183 square miles contained a population of only 2400 people, most of whom were Indians. After the admission of the Territory of Dakota into the Union a great influx of population took place. Government statistics show that during the first twenty years of statehood North Dakota enjoyed an increase in population of over 202 per cent. In this tremendous human wave that poured itself over this prairie state, there were, of course, many native born Americans who changed their habitation chiefly for economic reasons. The greater part of this flood, however, consisted of people wholly or in part of foreign blood. The United States census report of 1910 recapitulates the figures for the year 1900, that is, eleven years after North Dakota became a state. At that time, these figures show that 20.6 per cent of our population were native whites of native parentage; 41.8 per cent were native whites of foreign or mixed parentage, (by the term 'mixed' it being understood that at least one parent was of foreign blood); and 35.8 per cent were foreign whites. The figures for 1910 are no less interesting and show a normal development. The per cent of native whites of native parentage has increased from 20.6 to 28.2 per cent in ten years; the number of whites of mixed or foreign parentage has increased from 41.8 to 43.5 per cent, while the foreign white population has decreased

from 35.3 to 27.1 per cent of the entire population. The total white population of North Dakota in 1910 was 569,855, of which number 162,461 were of native white parentage, 251,236 of foreign or mixed parentage, and 156,158 were foreign born. In other words, 70.6 per cent of the white population of this state was either wholly or half of foreign blood. Of the number comprising the above 70.6 per cent, 150,084 were of Scandinavian stock, 59,767 were German, 62,186 Russian, 11,200 Austrian, 4,668 Hungarian, and 1,717 Swiss. It is apparent, therefore, that in its phenomenal growth the state affords remarkable opportunities for observing the making of Americans.

When the writer came to North Dakota he was interested to see that a little more than 14 per cent of the white population of the state was of German extraction. He noted, too, that according to the census report a large number of residents of the state were classified as Russians. Knowing that our census takers take cognizance of the country from which a man comes rather than the race he represents, certain doubts as to the accuracy of this statement arose in his mind. Unacquainted with conditions, however, he assumed that these people were actually of Slavic blood. But investigation and association with them have convinced him that his original doubts were well founded. Excepting a small per cent of Stockrussen, real Slavs, these so-called Russians are of German stock, the descendants of Germans who migrated into Russia many years ago. A similar observation was made in regard to the Hungarians. Only a small per cent of them are actually of Hungarian stock, but descendants of Germans who migrated into Hungary for economic reasons. The Austrians and Swiss, too, are for the most part of German descent. Thus it is seen that by computing the number of Germans, not by the number of immigrants from Germany and their descendants, but by taking a broader view of the problem, an ethnic view, considering all persons who have a German ancestry, we have a total of a race—German in blood, language, custom, and belief—of 137,708 or 24.2 per cent of the entire white population of the state.

The distribution of the German element is, of course, not even, tho there is not a single county in which this element does not constitute at least 3 per cent of the entire white population of that county. There are four counties in which more than 50 per cent of the white population is German: McIntosh with about 81 per cent, Mercer with about 68 per cent, Sheridan about 65 per cent, and Emmons with about 51 per cent. In eight other counties the

Germans represent from 30 to 43 per cent: Oliver with about 43 per cent, Morton 41, Stark 38, Dunn 38, Logan 35, Wells, 32, McLean 31 and Hettinger with about 30 per cent. Stutsman, Richland, LaMoure, McHenry, Kidder, Dickey, Billings (prior to the formation of Golden Valley county), and Walsh counties have a German population which represents from 20 to 27 per cent of the whole white population. In the remaining counties the German element represents from 3 to 17 per cent of the entire white population. Walsh and Richland counties are the only counties in the rich Red River Valley that contain a considerable number of Germans, a number that is at all commensurate with the Scandinavian element there represented. When the flood tide of German immigration struck the state, most of the rich land in the Red River valley had been claimed, and so it was necessary that, for economic reasons, they should go where government land was still available. As a consequence we find them in greatest numbers in the southern, western, and central counties. There they found a task vastly more difficult than that encountered by their Scandinavian friends in the valley of the Red River. The land is less fertile and, in part at least, semi-arid conditions obtain. In characteristic fashion they have there done, and are still doing, the trying but important work of the pioneer, just as their kinsman have done in this country since the latter part of the 17th century, for all along the line the Germans have borne well their share of the hardships of frontier life, all along the line they have helped to blaze the path of civilization.

The limits of this article preclude an adequate record of the notable contributions which the Germans have made to the life of this state. Full account is taken of this matter in a separate, comprehensive piece of work. Suffice it to say here that their attainments are numerous and worthy. The Germans are to be found in every line of work and endeavor, their inherent characteristics of honesty, industry, and frugality making them desirable settlers everywhere.

That class of Germans in North Dakota which represents an unexplored, indeed an almost undiscovered, mine of culturo-historical research, is that which has come to us from Russia. They call themselves Ruszlaender and not Russians. They despise the Russians, Stockrussen. They know themselves to be superior in every respect to the Russians who once served their fathers as serfs. Tho five generations of Germans have grown up in Russia they have stubbornly and successfully refused to become Russianized. They think

German, they speak German, they have the undiminished consciousness of belonging to a stock which is superior to the Slav.

The question as to how it happened that the ancestors of these Ruszlaender went to Russia is full of interest, tho the facts are not generally known. On the 4th of December, 1762, that is to say, before the Seven Years' War had been brought to a close, when there was a great deal of discontent in western Europe, Catharine II of Russia issued a manifesto in which she invited the people of Europe to settle in her wide-spread realm. This invitation, generous as it was, did not meet with any appreciable response, for the reason that the manifesto did not contain any assurances of definite rights and privileges to be accorded the newcomers who were to face the hardships of pioneer life. On July 26, 1763, Catharine II issued a second manifesto which stands unique in point of liberality of terms and generosity of inducement. The preface to this important document reads as follows: "Since the great extent of the lands of Our realm is sufficietly known to Us, We note that a great part of this Our country is still uninhabited, a part of which could be advantageously made useful as homes for the human race, most of which lands hold concealed within their lap inexhaustible treasures of metals and ores; and since these lands are also sufficiently well supplied with forests, rivers, lakes and navigable seas they are in an unusual degree adapted to the furtherance and increase of many kinds of manufacturing and other industries. This induced Us to issue the manifesto which was published for the benefit of all Our loyal subjects on December 4, of the past year. But since We in this maifesto made known Our wishes only in general terms to such foreigners who might desire to settle in Our realm, therefore we issue the following for the better understanding of Our offer, and command Our officers to make this manifesto fully known." The substance of the long document which was subjoined to this preface is the following, in brief:

1. Permission was given to settle anywhere in the Russian realm.
2. Special offices were created to care for the immigrants.
3. Applicants without means were to be supplied with the necessary funds to make the journey to Russia.
4. Upon arriving at the Russian capital the immigrant was to state what line of activity he wished to pursue, whether aggriculture, trade or manufacturing. He was also to declare whether he wished to become a citizen of the realm.
5. If advantage was taken of the privileges set forth, it was expected that the immigrants should become citizens of Russia.

6. Freedom of worship was granted, but proselyting among Russians was prohibited. Permission was granted, however, to bring the Mohammedan tribes on the border "to the acceptance of the Christian faith" and "to make them submissive to the wishes of the settlers."
7. Settlers were exempt from all taxes and duties and military service during periods of 5, 10, and 30 years depending upon the region chosen for settlement. Immigrants expressing their intention to make Russia their permanent home were to be granted free board and lodging for half a year.
8. Manufacturers were offered special inducement. Liberal land grants were held out to manufacturers of articles hitherto not produced in Russia.
9. The Russian national treasury was instructed to advance money to needy settlers for the purpose of building houses, buying live stock, implements, and tools. No interest was to be charged on such a loan, the principal alone to be paid back after a period of ten years.
10. Local self-government was assured.
11. No duty was to be charged on goods and property brought in by the settlers for their individual use, provided that such settlers remained in residence for ten years. If period of residence expired sooner, both import and export duty was to be charged on such goods.
12. Permission was granted to buy and hold serfs.
13. Market days and fairs were allowed without taxes or duties.
14. Descendants of immigrants, even those born in Russia after the arrival of the immigrants, were to enjoy the same exemptions as their parents.
15. Assurance was given that the military service and taxes which were to be rendered after the period of exemption should not be severe or excessive.
16. Permission was given foreigners to leave Russia whenever they might desire to do so, however, a small tax was to be levied upon the wealth such immigrants had gained in Russia.

These remarkably liberal terms brought thousands of Germans to Russia after the Seven Years' War had come to a close. Almost all of those who accepted the offer of the Czarina were poor, and thus simply sought economic betterment. So poor were many of them, that, as their descendants have told the writer, many made the trip from their German home to Russia on foot, conveying their scant belongings in wheelbarrows and carts drawn by hand. The

determination of the approximate number of German emigrants to the Baltic provinces, to Kherson and the interior provinces will furnish an interesting problem. The stories of almost unbelievable hardships endured by the settlers during the first few years of residence in Russia, hardships occasioned by the primitive conditions they encountered and augmented by the savage deportment of half savage tribes in residence, are still current among the descendants of these people today. But in due time they prospered. Indeed wealth came all too easily. The Germany of their day was not the economically powerful country of today and so the lessons of economic manipulation of wealth were wholly unknown to these immigrants in Russia. Land was plentiful, it could be had for the asking, the climate of southern Russia, where most of our North Dakota Ruszlaender came from is mild and produces an abundance of a great variety of crops of the field, garden, and vineyard. All this led to wasteful habits. The writer has heard the Ruszlaender relate almost unbelievable stories of almost criminal wastefulness on the part of those early settlers in Russia. Such habits later generations had to overcome amid great hardship.

Educationally, too, these immigrants had had but small advantages in Germany, for the excellent educational system which their Fatherland now boasts was undreamt of at that time. Russia had nothing to offer for their amelioration in this line. Even now the masses of Russia grope in darkness, educationally. The church schools which the German settlers organized there were naturally not of a high grade either. In these facts we must therefore seek the explanation as to how it happens that in some of the Ruszlaender settlements in this state 25 per cent of the foreign born are illiterate. It is interesting to observe the descendants of these Ruszlaender when they are given an opportunity for education in our schools. The writer has had occasion to observe them in the high schools and the university where they reveal an aptness and a zeal which proves that the old original stock is not dead but that it has been simply neglected. He has seen exceptional ability displayed by these young Americans. He has also noted the pride with which the more wide awake parents of these youths glory in the advancement which their children are making.

During the years of exemption mentioned in the manifesto of the Czarina there was neither necessity nor inclination to make changes, nor were the means at hand to migrate. By and by the policy of Catherine II was set aside, taxes became oppressive, and military duties irksome. Finally, the Russian government even set

out on a definite plan to Russianize its German subjects. Then it was that the German wanderlust began to manifest itself again. Thousands upon thousands left the Russian borders for more hospitable climes. The United States of America was the magnet which now drew the heartsick, but yet indomitable, colonists. In the wake of a few venturesome spirits a veritable flood of humanity poured itself into our northern states during the third quarter of the nineteenth century. North Dakota profited by the emigration. The account as to how the Russian government sought to prevent the emigration of the Ruszlaender and the eagerness of the latter to reach the promised land of America constitutes a most fascinating chapter of history.

Our Ruszlaender present a many-sided study of absorbing interest. In the first place it is interesting to see with what tenacity they have clung to the language of their fathers, preserving even the minutest detail of the respective German dialects which their ancestors happened to speak at the time of migration. They know scarcely any Russian. They account for this bit of ignorance by stating that they lived in colonies where the German predominated, but chiefly because they regarded the Russians as their inferiors in every way. They despised the Russians, refused to intermarry with them, and looked upon them as their former slaves, which in fact many of them had once been. One Ruszlaender told the writer, upon inquiry on this point, "We looked upon the Russians, as far as social standing and education go, as you look upon your former negro slaves." In this country they accept the English language with eagerness because they recognize its value and importance. Their adaptability and manifest desire to become good citizens are great points in their favor.

The student of the cultural facts of history finds many things to rejoice his heart among these Ruszlaender. They have preserved a great number of interesting customs and beliefs. Some of these are purely German in origin, while others have undoubtedly been colored by their Russian environment, while still others have taken on an American hue. Their weddings are attended with unique ceremonies and accompanied with much feasting. They are the possessors of many superstitious beliefs, especially in regard to medicine and the art of healing.

In regard to survivals of old customs and beliefs, the Germans of the German Empire are vastly poorer than their Ruszlaender kin. The reason, it seems, is this—the Germans of the Empire come to us from so many different provinces and countries of Germany, that

they do not find themselves the possessors of the same kinds of traditions, customs, and beliefs, and, having no common meaning, the old usages and customs have died out. The Ruszlaender, on the other hand, feel themselves more of a unit, many of them having come from the same region in Russia, and in their voluntary isolation in their settlements here they preserve the old more jealously.

From the Russians they have learned to smoke cigarets which they make themselves and in which operation they display much dexterity. They are also said to be fond of alcoholic drink.

Their lack of intelligent business experience in Russia and then their free and easy life as homesteaders in America has made them poor business men, in a way. Many of them have fallen victims to the cunning of low, unprincipled American land agents. As a class they fail to calculate in advance, fail to keep close check on their transactions, buy as long as their credit is good and after the harvest they pay the merchant according to the latter's own figures and are thus sometimes grossly cheated. They are known everywhere for their honesty in meeting their obligations.

They are undoubtedly a valuable asset to our state. Their exceptional hardiness makes them well adapted to pioneer life. They are strong and have the willingness to do all sorts of work. Men, women, and children work in the field. Indeed, one great danger is that they work too hard. In their eagerness to make headway in a financial way, they neglect the intellectual rights of their children. There are many portions in the western and southern part of our state that were once thought fit only for the grazing of cattle, which portions the thrift of these sturdy Ruszlaender has transformed into grain producing regions and dairying centers. It is true the mass of them have yet much to learn in the line of cleanliness and the true art of living, but as pioneers in an undeveloped country they are rendering a great service and their posterity will render, and is even now rendering, their due quota of service.

In the matter of religion they represent various faiths. Clergymen who have worked among them assure the writer that almost every kind of religious organization has found a foothold among these Ruszlaender.

Two distinctly German settlements of which the writer has made a detailed study will now be considered briefly. These settlements are those at New Salem and at Hebron in Morton county. With the development of the great Northwest the German Evangelical Synod of North America began to consider ways and means

of extending its sphere of influence into this new and undeveloped territory. In the eastern part of the United States the Lutheran Church had rather successfully preempted the field among the Germans. So the German Evangelical Synod determined upon expansion in the west.

About the year 1880 the Northwestern Colony Association of Ripon, Wisconsin, was organized and had effected a settlement in the west. (It is said that this settlement was at Gladstone, North Dakota.) The Reverend C. Dalies, a clergyman of the Evangelical church at Ripon, Wisconsin, was interested in the above named Colony Association. At a gathering of Evangelical clergymen at Harmony, McHenry County, Illinois, during the days of September 26 to 28, 1882, he urged that the Evangelical church follow the example of the organization in Ripon and launch a colonization scheme in the Northwest and to use this means to extend the church into these undeveloped regions, at the same time offering opportunity for poor Germans to find independent homes. The plan at once found favor. A committee on ways and means was appointed, which committee convened at Chicago on October 17, 1882, and founded the German Evangelical Colonization Society of Chicago, Illinois. Sixteen of the twenty-three charter members were clergymen of the above named church. A committee on location was detailed to investigate various regions for the proposed settlement. The church papers, notably the Friedensbote, and the German press of the western states generally gave the widest publicity to the undertaking. In all, 315 persons became members of the society by signing its constitution and paying the sum of $20.00 into the treasury. The constituency of the society extended over thirteen states of the Union and into Germany. The minutely kept record shows that almost every conceivable profession was represented in the membership of the organization. The average age of the signers was 35 years. Only a small fraction of the signers of the constitution actually took part in the settlement of North Dakota. The record, strangely enough, is not explicit in telling what regions were considered by the committee on location. It may be safely inferred that the settlement made by the Ripon colony directed them into this part of Dakota Territory. The site which was recommended was located a few miles west of Blue Grass siding on the Northern Pacific Railroad, in Morton County. There were then no settlements anywhere in that region. Indeed between Mandan and Dickinson, a distance of over 100 miles there was only one small coal mining town, Sims. On the morning of April 3, 1883, the

vanguard of the sturdy German pioneers arrived at Blue Grass, from where they proceeded, most of them on foot, to find the selected site which they named New Salem.

Encouraged by the example of the society just discust, other Evangelical Germans banded themselves together to found a similar organization under the title of German Evangelical Colonization Association of Chicago, Illinois. This body perfected its organization on October 16, 1884. Its purpose, too, was that of settling in the Northwest and of transplanting the Evangelical church into that region. They, too, sent out a deputation to locate a suitable site for the settlement. After extensive wanderings the site of the present town of Hebron was decided upon as a nucleus of the proposed colony. They had the benefit of the experience of the New Salem colony and in many ways followed its example. One mesure which the officers of the younger organization constantly insisted upon was this, that only such men as were able bodied and willing to battle with the wilderness, and who had at least $500.00 in cash, should venture to go to the settlement. Due, no doubt, to such precautionary mesures, the Hebron colony was spared certain unpleasant experiences which a better mutual understanding might have avoided at New Salem. Early in April, 1885, the first allotment of settlers arrived at the present site of Hebron, then a vast unimproved prairie country.

The centralizing factor in these two settlements was and is, even today, the German Evangelical Church which was established by the founders. The scope of this brief article does not permit a searching account of the history of these sister colonies. In a subsequent piece of work which will deal with the details of these settlements the points of coincidence as also the points of difference will be adequately treated. There it will be seen how in each instance the procedure was thoroly businesslike from the very beginning; how sets of business men were appointed on committees to make agreements with manufacturers of agricultural implements and for the advantageous purchase of such implements by the colonists; how other committees interviewed the railroad officials to secure the lowest rates to the immigrants; how the prospective settlers purchased considerable quantities of lumber in Chicago for their homes on the prairie and how the trip from Chicago to North Dakota was actually made. The discouragement which prevailed when the settlers arrived at the bleak site chosen for the colony will there be portrayed, and how they lived in the bunk cars of the railroad company till their rude shacks were erected, also how each selected

government or railroad land as it suited fancy and purpose. An attempt will also be made to show how the first winters, which happened to be unusually severe, were spent and, tho homesickness gnawed at their hearts, how they devised amusements to while away the long bleak winter evenings, and even how they planned a celebration of their first Christmas in the new land around the scantily decorated Christmas trees.

In that same presentation an equally interesting topic will be taken up in showing how they eked out a scanty existence by gathering the bleached bones of one-time countless herds of buffalo for which they received from ten to twelve dollars per ton going for them, sometimes, as high as sixty miles and accumulating on the right of way of the railroads immense quantities to be shipped by some enterprising agent to the older states. How they toiled on the railroads, building the track in summer and fighting the snow in those awful winters will likewise be shown. But Nature was not always against them. She even at times furnished them their meat supply from the numerous herds of antelopes and deer and the countless flocks of wild aquatic fowl that bred on their farms. The dismal sight of the nearly impoverished communities will be depicted when, during the first few years, the crops were almost total failures. The situation was so bad at one time that a few men of means kept alive their financially less fortunate fellow-colonists by purchasing great herds of cattle and great flocks of sheep, parceling out to this settler so many head of cattle to feed and care for at a stated sum per head, and to that settler so many sheep for half the lambs and half the wool. These were uncommonly hard years, years that tried the souls of men but they were followed by years of such uncommon abundance that granaries could not be provided fast enough and the grain had to be heaped in great piles on the bare ground awaiting shipment. All this will be told in detail, also how the first crops of grain were threshed in the most primitive manner by having cattle or horses tramp it out on the ground, and how the grain was winnowed by letting the prairie breezes blow away the chaff. It was under these circumstances that the "bumper" was invented and used, a crude device it was, a roller upon which strips of timber were nailed to give it an uneven gait as it was drawn by horses or cattle over the piled-up grain.

The article mentioned above will show, too, how the colonists grew rapidly in numbers and finally in comforts, and how comfortable homes replaced the old sod houses and rude shacks, and handsome places of worship the first crude churches. We shall go

on to relate how the peaceful and prosperous settlements were disturbed by the report from Bismarck that Indians under Sitting Bull had left the reservation; how arms were demanded and received from the governor of the state for their defense; how military companies were organized under the leadership of those who had seen service in the army of the Fatherland; how for the protection of the whole community the people of Hebron constructed a fort of sod on one of the buttes near the town, which fort is still traceable and which its builders now humorously call Fort Sauerkraut. The interesting incident of John Moltzen will be told in some detail, John Moltzen, an old soldier, who gathered his neighbors around him and fortified a butte on his farm by piling up a great mass of boulders to form a barricade. The same study will show how Hebron celebrated its twenty-fifth anniversary in a most pleasing manner, presenting in a simple pageant the various phases of its early development. Its later successes will also be shown, how its brick and tile manufacturing is utilizing the valuable clays of the state, and how diversified farming is being practised and all sorts of fruits and garden vegetables not ordinarily raised in this state are there produced. New Salem's impressive celebration of the thirtieth anniversary of her settlement will be given, also how her Holstein Breeders' Association is teaching North Dakota farmers the unfailing importance of dairying industries. In it all and thru it all there will appear how the purpose of these pious and at the same time businesslike founders has been splendidly accomplished, how a thrifty and God-fearing people have wrested from the wilderness places where now wealth and goodwill abound and where benevolent deeds are done. When this panorama is seen in full, the conclusion is forced upon us that here on the prairies of North Dakota there have been erected two more monuments to German integrity, perseverance, and idealism.

Some Recent Decisions of the Supreme Court of North Dakota

O. G. Libby,

Professor of History, University of North Dakota

THERE has been in recent years a good deal of general criticism leveled against our courts, both Federal and state. Some of the criticisms have been aimed at well known defects and in many cases needed reforms have been secured. In other cases, however, the attacks have been not only unfair and prejudiced, but the views they represent and the principles upon which they are based are so manifestly unsound in theory and practise that it is hardly worth while offering any reply to them.

The judicial departments in our state and Federal governments are in many respects unique experiments in administration, having few counterparts among European states. The important place that this department holds in a well ordered state has not been as universally recognized in the past as it is at the present time. Historically, the legislative department, both in America and in England, has had constantly to struggle to maintain itself against the usurpations and the prestige of the executive. The Puritan Revolution was primarily a struggle of Parliament and its middle class constituency against the claims of an arbitrary monarchy. The English colonists, most of whom settled in Virginia and in New England during the period of conflict, brought to America and perpetuated in their political institutions this Parliamentary theory of executive subordination to the legislative department. Our first Federal constitution under which we fought the American Revolution was framed on this political theory and is an excellent example of the extreme application of its principles. Even in our present constitution there are abundant traces of the profound disbelief in the essential value of the executive department.

Since the adoption of our constitution the Federal Supreme Court has had to contend against the prejudice arising from the fact that this court was popularly supposed to be merely an adjunct of the central executive. At the two points in our history when there was a popular reaction in favor of a free democracy and greater authority lodged in the hands of the voter, namely the administrations of Jefferson and Jackson, it is a significant fact that the Supreme Court was openly or covertly attacked and its findings were subject to a good deal of sharp criticism and invective. More recently, with

the control over law making which has too often been allowed to pass into the hands of the wealthy few, the courts appear to have been discriminating against one class in favor of another. In reality, the courts have in these cases simply been construing correctly the laws passed by the interested few with the full sanction or tacit acquiescence of the indifferent many. Now that this popular indifference is passing away and greater activity is manifested everywhere in the nature and scope of legislation, both the Federal and state courts have found a new field of interpretation in checking inconsistent and conflicting legislation and in giving effect to what was actually provided for by a given law or by some series of enactments passed by the legislature with certain definite aims in view. This important and far reaching function of the average state court has in view tendencies as well as origins and precedents. If popular rule is to mean anything for the future and if self government is to develop logically and normally with the progress of our nation in every other field of activity, there must be some agency vigilant, wise, and far sighted, whose special function it shall be to preside over the legislative process and give to its decisions their full and complete effect. This function of the court is deliberative not legislative; it is an interpretation not an enforcement of law. In recent years there has been a decided trend in public opinion toward increasing the scope of action and widening the responsibility of the legislative department of government. By initiative, referendum, and recall laws this process has been extended also in some cases to the voting constituency itself. This movement is widespread and has penetrated to all classes of citizens in every station of life. Thus there has developed a very decided reaction against the counter process now going on in the administrative field toward centralization of control.

The relation of this popular reform for the extension of the legislative field has most important bearings on the problems and point of view of the judiciary. American Democracy is asking some very pertinent questions of its courts and of its judges. Upon the answers to these queries will depend in no small mesure the place held in our future popular government by the departments of justice. No small part of our voluminous court record contains invaluable material for the guidance of the legislative bodies in their difficult task of pioneer law making in the new fields they are just entering. In the case of that vital question of community responsibility which lies back of so much of recent legislation aimed at old abuses and traditional wrongs, the duty of the courts is to point out

the safe road for reformatory legislation so that permanent results may be attained. This can be done, and has repeatedly been done, by presenting an opinion containing an historical resume of previous laws and decisions from which can be worked out a line of action that is logical yet not revolutionary, and which may be followed later when time has shown the wisdom of further reform. When the courts perform their coordinate function in conjunction with the legislatures, they can not only insist on making haste slowly but they can even cut down the waste of useless agitation for the repeal of laws hastily and loosely drawn, and also help the state to avoid the breakdown that attends the enforcement of unwise or unjust enactments.

In some recent decisions, the supreme court of North Dakota has shown that it has taken a decided stand for progressive legislation both by its point of view and by the grounds stated in support of its position. Two cases dealing with totally different subjects, yet covering in the main the same essential ground, illustrate clearly how the state supreme court construes legislative enactment when doubtful points of administrative responsibility are raised. The first one is the well known Tax Commission case in which the state auditor questioned his right to pay the salaries of the members of the Tax Commission on the ground that no specific provision for this payment had been made by the most recent legislation on the subject.[1] The court held in effect that the legislature in its capacity as representing the soveren people of the state had created the Tax Commission and no subsequent action had effected any material change in the duties or the form of the commission. For this reason and as interpreting the evident will of the voters by the action of their representatives the court set aside a considerable number of technicalities which might seem to cast doubt upon the status of the Tax Commission and directed the state auditor to continue paying the salaries of the members of this board, thus continuing one of the most useful agencies in our state administration.

One of the most pregnant observations in this decision is to the effect that all constitutional limitations as to appropriations and expenditures have their origin, historically, in the effort of the people thru convention and legislature to limit the executive or administrative departments in their expenditures of the state revenues. Such constitutional limitations lose much of their force, however, when they are made to apply as a restriction upon money expended by the legislature directly, or appropriated by them for use in the various

1. State ex rel. Birdzell v. Jorgenson, 25 N. D., 539.

departments of state. There seems to be in this decision a conspicuous absence of mere technicality and traditional observance of rules. The whole question is obviously discust on its merits, with the widest possible latitude of construction of the law. All that is sought to be attained seems to be the fullest mesure of advantage to the entire community. To quote: "Of all the presumptions the strongest is that our legislators are serious-minded men, and are not trifling with politics or with government. The presumption, therefore, follows that they did not intend to create a commission and then to strangle it by failing to provide for its maintenance."[2] This may or may not be good law but it is something else still more to the point, it is most excellent common sense. There is no danger that a court of justice that savors its decision with this kind of reasoning will ever lose touch with public progress or general community welfare. Such rulings as these help us to keep step in the forward march of reform and offer abundant guarantee of effective leadership along every line of needed social betterment.

In the court martial case of 1909 relating to the status of an officer of the National Guard of North Dakota, the supreme court set aside a decision of general court martial on the ground that the sentence was passed without jurisdiction.[3] The case involved the definition of the relative fields of authority occupied by United States law and state law, and there is also a less important point as to the scope of the executive function in our own state. The court held that in all civil matters the state law was supreme and that a citizen could not be considered as coming under the jurisdiction of any other law, such for instance as the Articles of War, while he was not a member of our regular army or during time of peace. The state law does not provide for the trial of members of its state militia for a felony by court martial during a time of peace, while it does provide abundantly for the ordinary rules of discipline, drill, and uniform necessary to maintain its organization. The obvious intent and purpose of the state legislature is here held to be the rule paramount in deciding cases involving purely technical conflicts of jurisdiction or details of administrative policy.

In the snuff case the issue is more comprehensive but practically the same principle is involved.[4] The anti-snuff law of the state, passed in 1913, provided drastic legislation for the exclusion of snuff or any substitute for it. The first point decided was as to the extent of the police power of the state. The court held that the state had

2. State ex. rel. Birdzell v. Jorgenson, 25 N. D., 567.
3. State ex rel. Poole v. Peake, Adjutant General, 22 N. D., 457.
4. State v. C. J. Olson, 26 N.D., 304.

complete police power over the sale or manufacture of tobacco and that there could be no judicial inquiry into the motives that actuated the legislature in providing such repressive legislation against the use of tobacco. Public health and morality may be conserved by such regulations and extension of the police power as do not openly and plainly contravene any well established principles of justice or such legal and constitutional safeguards as have already been established. To quote from the decision: "There is in fact no vested right or interest in that which is a nuisance or the use of which is injurious to the public weal."[5] "So, too, conceding, as we must concede, that the use of tobacco in any form is to a greater or less degree harmful, can this court interpose its judgment and discretion and theory on an ultimate question of fact and public policy against that of the legislative body, which comes directly from the people, is in close touch with industry and the ordinary activities of life, and has the opportunity of a thoro investigation by means of committees and research?" [6] As to the contention that the law makes a wrong classification of the tobacco offered for sale in the state, the court ruled that such definition was fully within the power of the people of the state thru their representatives, and was based upon the general concensus of opinion of the entire body of voters. This is not a technical and obscure verdict but one easily understood by the average citizen and voter in any community and it is, moreover, a decision that vigorously supports the combined good sense of the masses in their efforts to rid themselves of dangerous and deleterious products offered for sale in the state. The robust common sense that permeates this decision should appeal most strongly to every public spirited citizen.

In the bonding case a law enacted by the legislature in 1913 was declared by the court to be invalid because of unwarranted delegation of legislative and of judicial power to an executive officer, and because it was in conflict with various provisions of the state constitution and of the Federal Constitution.[7] This function of reviewing the action of the legislature and of passing upon the constitutionality of such mesures as come before it for that purpose belongs to quite another chapter of judicial prerogative from the one we have just considered. In this respect our judicial department stands unique as compared to that of England and of most of the continental states. In no other capacity is the expert training and special knowledge of a judge so much needed as in cases of this nature.

5. 26 N. D., 321.
6. Ibid., 326.
7. State ex rel. Miller v. Taylor, 27 N. D., 77.

This may be rightly considered the particular field of authority where the judicial department can be said to have no rival. Questions of statutory interpretation, the clash of Federal with state jurisdiction, the scope and trend of constitutional provisions are all determined by the court sitting as the final authority. And to the credit of the average legislature it may be said there is little disposition to dispute the paramount jurisdiction of the judiciary in this field.

The relation of railroads to the public is a subject over which endless controversy has been waged. On the subject of responsibility in railroad accidents there is so much difference of opinion and such widely divergent view points that court decisions usually satisfy no one and leave the whole question as unsettled and confused as at first. The decision in the case of Rober vs. The Northern Pacific Railway contains a very interesting discussion on what constitutes risk at railroad crossings and the mutual responsibility of the public and the railroad.[8] The decision has special significance as pointing out the line of reform legislation which will ultimately be followed by the community to protect life and limb at the numerous grade crossings in every city and town in the state.

The stubborness of railroads in holding out against public sentiment in the matter of safeguarding crossings can have but one result, that of hastening the enactment of drastic legislation which shall fully protect every citizen. In deciding this case against the railway company, the court goes on record as according the community the fullest latitude in the matter of protecting its citizens by any laws that may seem effective. There seems to be, however, no disposition on the part of the court to hold the railway corporation unduly in check as far as relates to grade crossings. The conclusion one reaches from the reasoning in this decision is that the public has the paramount right in all such cases as against any or all property rights of mere individuals. If in the operation of any public service corporation human life is sacrificed, the community has an indisputable right to hold such corporation strictly to account for loss of a working member of the social group.

The lignite coal rate case is far-reaching in its scope and involves the whole question of railroad valuation and profits, as well as the equally fundamental question of the rights of the shipper and consumer upon whom the rates ultimately fall.[9] In spite of the fact

8. Rober v. Northern Pacific Railway, 25 N. D., 394.
9. State ex rel. McCue v. Northern Pacific Railway Co., the Great Northern Railway Co., and the Minneapolis, St Paul and Sault St. Marie Railway Co., 26 N. D., 438.

that this decision has been reversed by the Federal supreme court, the nature of the contentions maintained and the significance of the decisions reached place it among the noteworthy cases involving the relative position of the railroads in modern industry. The state law of 1907 fixing a maximum for lignite coal rates was held by the defendants to be confiscatory and as violating the fourteenth amendment of the Federal constitution. The case first came before the state supreme court in 1909 and the rate was upheld. The Federal supreme court sustained this decision but permitted a reopening of the case after a further trial of the rates had been made by the railway companies.

Among the points of general interest urged in support of the findings of the state court was the clear line of demarcation made between a non-compensatory rate and a confiscatory rate, a distinction of fundamental importance in the case in hand. Again it was held that the entire profit of operating the freight business of a railroad company must be taken into account in passing upon the effect of a law affecting freight rates. In other words to carry the meaning of the decision into actual operation the public have a right, at certain times and under conditions that are deemed fair and equitable, to make such demand upon public service corporations as seem best for the promotion of the well being of the whole community. These demands may have an industrial end in view or they may be made in the interests of health or better morals. The soveren power of the state recognizes no bar in the rights of individuals that can effectually stop the operation of mesures enacted into law for the public welfare. Lastly it was pointed out that the proper basis for estimating return on investment was a complete inventory of all property contributing to the production of this profit and that until complete evidence of this nature was forthcoming, any conclusions as to the effect of the maximum coal rate complained of must necessarily be unsatisfactory and inconclusive. The inevitable effect of this policy of opposition to these demands of the public will be a state valuation of railway company properties not merely to establish a scientific basis for the study of freight rates but to prepare for the inevitable readjustment of the whole matter of state assessment and taxation. The decision is one of the clearest indications of the trend of public opinion on the subject of readjusting our tax system to the actual wealth of the state and it is not without significance that our highest court should thus point the way toward reform.

In summing up the decisions in the typical cases cited above, it is clear that our state court has taken advance ground fully abreast

of the most progressive tendencies recently manifested by our legislatures. Nor is it difficult to discover in the general tenor of the decisions examined a clear understanding of the legitimate function of the judicial power and the possibilities of co-operation with the public in giving effect to their demands for permanent and scientific reform. Furthermore, there is evident in the ground taken by the court that the members are animated by a determination to keep the judicial department from encroaching upon any other, to the end that a perfectly harmonious balance may be maintained among all the co-ordinate departments of government, an ideal toward which we have striven ever since the first dawning of national self consciousness. The following quotation illustrates this clear cut distinction held to exist between judicial and legislative prerogative and it is typical of the broad and scholarly appreciation the members hold of the place of the judiciary in American political life. "The courts can and should take judicial notice of those facts which may be judicially noted, that is, facts of common notoriety and knowledge, and above all they should recognize the prerogatives of the legislature as well as their own"[10].

While, therefore, it has long been evident to the historian that as a nation we have been steadily advancing toward a more completely centralized executive and a legislative department closer in touch with a citizen constituency the general tendencies at work within the judiciary have not been fully realized. We may safely conclude, however, that this important department is also passing thru its historical evolution and that it will become in the future as broadly national and popular as is required for it to remain typically American.

10. 26 N. D., 325.

Notes on the Legal Phase of the Trial of Jesus

WALLACE NELSON STEARNS,

Professor of History and of Religious Education, Fargo College

OUTLINE

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   The Question one of Roman provincial criminal procedure and of Jewish Rabbinical law, c 30 A. D.

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THE CASE STATED

IT must be borne in mind thruout this investigation that we are to consider, not from the legal view-point of today, but from that of the first Christian century: first, from the standpoint of Jewish ecclesiastical law, and, secondly, in the light of Roman provincial criminal procedure. English law traces back to Anglo-saxon origin; it is a product of western rather than of Southern law[1]. Further, in the consideration of the present case note must be made of the difference between ordinary legal procedure and the ruling that prevailed under peculiar conditions such as existed in Judaea during Pilate's procuratorship. And still further, the line of cleavage must be accounted between Roman and Jewish legislation, and there must be taken into consideration also the changes in Jewish legislation between the year A. D. 30 and the date of the publication of the Talmud, c. A. D. 200. Would the changes during these troublous years be of a nature to relax the rigor and vigor of the law or would persecution and proscription tend to render legal observance more punctilious and exacting? It must be borne in mind, also, that Jesus, unlike Paul, was not a Roman citizen. Before preparing our brief, then, it will be necessary to determine:

1. Thatcher and Schwill: The Middle Age, pp. 67 and 74.

(1) The Roman legal procedure in the Imperial provinces, c. A. D. 30[2].
(2) The Jewish ecclesiastical law at the same date, and
(3) The priority of either over the other[3].

Roman Criminal Procedure

As early as the XII tables Roman law had placed the death penalty in the power of the Centuriate Assembly. One of the principles worked out by the Republic was the appeal to the people as over against the soveren power of the now-banished kings. Hence arose the "Provocatio" or challenge to a magistrate as to the scope and justice of his provenance. The specific origin of the institution may not yet be fully determined.

The Lex Valencia (509 B. C.) placed in the hands of the people the final decision as to scourging, and as to the death penalty when executed within the walls whether that boundary were the pomerium or the mile-limit beyond. The third Lex Valencia (300 B. C.) granted appeal from execution of the death penalty after judgment had been passed. To this added sanction was given by the Lex Porcia (197 B. C.). The prosecution of Verres, for example, was a protest against the violation of the spirit of the Porcian legislation in executing a Roman citizen in the provinces. Finally we need but to cite the appeal of the Apostle Paul; "Are you allowed to scourge a Roman citizen—and to scourge him without a trial[4]?"

But Jesus could not claim the protection of Roman citizenship, he was a humble native of a conquered province at that time under the jurisdiction of a special governor—practically under martial law.

Within his province the governor had complete jurisdiction[5] Custom directed an advisory council made up—to insure fair dealing of *local citizens and members of the governor's retinue*[6]. For lesser crimes the local courts probably sufficed[7], but in extreme cases, as sedition, offenders were sent to Rome[8]. Looseness in the system of extradition existent under the Republic would be one of the points corrected under the more closely organized Empire. Under the Republic this jurisdiction in the provinces extended even to Roman citizens[9].

2. Edersheim: Life and Times of Jesus the Messiah, I, p. 62.
3. Graetz: History of the Jews, II, pp. 128-9.
4. Acts, XXII: 25-29. XXVI: 31f.
5. Cicero in Verres, II, 11, 30.
6. Even to calling in the governor of a neighboring province, in Verres, II, 1, 29.
7. Cicero in Verres, IV, 45.
8. Ibid, II, 1, 33.
9. Ibid. II, V, 63.

A question yet remains as to the priority of Roman law over native laws in the provinces. Limitation of power came about when by special act rights were granted to certain states, either thru treaty[10] or by a charter of privileges. On par with the Italian communes, these free states directed their own finances and held their own land. Such cities, for example, tho within the bounds of a governor's province were yet not of it. Of such relationship in Judaea there is no record. This absence of record, the fact of Judaea's separation from Syria for administrative purposes, and the state of martial law incident upon Judaea's rebellious career and consequent separation all prompt us to believe not only in the supremacy but also in the priority of the Roman legal procedure. Add to this the fact that Jesus held no claims to Roman citizenship and we place the defendant utterly at the mercy of the Roman governor.

Jewish Legal Procedure

Jewish legal procedure was defined with great exactness. There were three courts. In small towns with a male population of at least 120 there was a court presided over by three judges. This court was limited, did not have the power of death, and was not the ruling court in Jerusalem. The next higher court was presided over by twenty-three judges, and in some cases at least, had the right to affix the death penalty. Tradition fixes two such courts in Jerusalem: one at the entrance to the Temple-court and the other at the entrance to the inner court. The Great Sanhedrin with its seventy-one judges, met in one of the Temple Chambers or in the Temple shops. Circumstances point to this as the tribunal in question at this time.

The appointments of this court[12] were very exacting. The judges were promoted either from the lower courts or from the foremost of three rows of disciples who were always present to hear the decisions of the court. Twenty-three of these judges were necessary to a quorum. Altho in civil cases any might serve as judge, in criminal cases none could judge save priests, Levites, and such as might legally marry a priest's daughter—i.e. a full-blooded Hebrew. In capital cases the arguments for acquittal were heard before those for conviction. If a person spoke in favor of the accused he could not afterward speak against, altho the reverse was allowed. The prisoner might be acquitted on the day of the trial, but sentence

10. Mommsen, Staatsr., III, p. 1171; Greenridge, p 111f.
11. Greenidge, pp, 111f, note, 112.
12. Talmud-Sanhedrin, Eng. Trans. p. 14 mid.; p. 19 bot.; p. 39 boto; Chaps. 5, 6, 7, 9.

could not be passed until the day following[13]. Accordingly capital cases could not be commenced on the eve of a Sabbath or of a legal holiday. Disciples, tho in lesser cases they were allowed to speak either for or against, in capital cases could only speak in favor of the accused. In voting, the younger members voted first to avoid being influenced by their elders, and in capital cases more than a bare majority was necessary for condemnation. A majority of one would acquit, but a majority of two was necessary to condemn. Furthermore, forty years before the destruction of the Temple, i.e. A. D. 70—40=A. D. 30, the Sanhedrin lost the power of capital sentence.

Great care, too, was taken in criminal cases with the evidence. Witnesses were warned to beware lest their testimony prove to be based on supposition or on hearsay or might be otherwise unreliable. Witnesses were further warned of cross-examination and of the fact that whereas in civil suits injury could be atoned for by a fine, in criminal cases the blood of the executed and his descendants rested on the originator of the execution. Furthermore, criminal cases could be tried and capital penalties passed only in the regular meeting-place of the Sanhedrin, and not, as stated in the Gospels, in the house of Caiaphas or of any other man public or private.

The Sanhedrin was presided over regularly by the Nasi or president (Ab-beth-din). In B. C. 47 Julius Caesar[14] on the occasion of his visit to Syria appointed Hyrcanus II Ethnarch and high-priest of the Jews and with all the rights and privileges accorded him by the Jewish law. About B. C. 40 Hyrcanus was deprived of his political honors by Herod, and soon after by the loss of his ears was incapacitated for the high priestly office[15]. With the extinction of the Hasmonean stock the high-priests became the appointees of the political rulers[16], altho chosen, as a rule at least, from a few privileged families. Of the appointees of Herod Caiaphas was the fourteenth.

There were four modes of execution practised among the Jews, —stoning, burning, slaying with the sword, and strangling[17]. Crucifixion nowhere appears, and the instances of quartering recorded in the book of Maccabees were at the instigation of Syria.

To rightly appreciate the Talmud one must consider the vicissitudes thru which it passed with the people whose life, fortunes,

13. In case of profanation of the Divine name exception may have been made.
14. Jos.: Antt., XIV, x, 2-10.
15. B. C. 31.
16. Schuerer II, 1, pp. 196ff.
17. Sanhedrin VII.

and very soul it epitomizes. Herod's death left all the elements of discord with no strong hand to guide or control. From this time until the Talmud was finally formulated[18], Palestine was in a constant state of ferment.

(1) At the very outset there was Jewish hatred for Roman rule and for all who were suspected of sympathy with Rome. The question of the tribute is eloquent of scorn and hate. The triumphal entry of Jesus into Jerusalem was to the Jewish mind an intimation of the upheaval that was to throw off the accursed Roman yoke. Again and again did the populace bare their bosoms and defy the Roman soldiers to draw their swords.

(2) There were factions led by fanatical leaders, zealous but without power or ability to effect organization. There were many such, as Judah ben Zippori, Mathias ben Margalot, Simon, Athronges and Judas of Galilee. The bitterness of these bands wrought destruction to friend and foe and anarchy to the state.

(3) Thruout the country lived Greeks, foreigners who because of the encouragement afforded them in this entire period, had settled among the people. They brought with them Greek culture and customs. These new ideas the Herods had sought to propagate, often with violence and always to the detriment of the traditions of the country. These Greeks the Jews regarded as a prime cause of their troubles, and cordial, indeed mutual, hatred often resulted in riot and bloodshed.

(4) The old quarrel between Pharisee and Sadducee burned fiercely. The Sadducee was the liberal, favoring the incoming of foreign ideas, and enjoying the favor of the captor nation. The Pharisee clung with tenacity to the traditions and beliefs of the fathers. He hated the foreigner and looked for the deliverer that would redeem Israel from serfdom. He sat on Moses' seat and interpreted the law, and despite the fact that he drew a line between himself and the ignorant crowd who knew not the law, he was the friend and advocate of the people, on whose support he could always count. The Pharisees represented the solid core of orthodox Judaism.

(5) There were heightened theological differences. In B. C. 31, Herod had appointed as one of the Presidents of the Sanhedrin one Hillel, a Babylonian Jew. Hillel was a devoted student of the law, mild and conciliatory in spirit, and admirably fitted for the place. His foreign nationality subjected him for a time, however, to much odium. Hillel's deputy was Shammai, a man his very oppo-

18. The Mishna c. A. D. 200 and the Gemara in the fourth and fifth centuries A. D.

site, a literalist severe and exacting. The views and teachings of these two men formed the nuclei of two opposing camps, and the ardent Oriental spirit added edge to theological feud.

(6) This pitiable state of affairs was made infinitely worse by the quarrels of Herod's heirs. While they were wrangling and often absent in Rome with their litigations, the country was cared for indifferently by Roman officials. Partisanship was rife, and the country was given up to civil war and anarchy.

(7) The beautiful cities erected by Herod and sons, but peopled often by heathen folk, were a constant reminder of Judaea's humiliation. Heathen customs, religious rites, and Greek culture dominated these places. The new ways were an abomination in the country and a stench in the nostrils of the faithful.

(8) On the flanks of Judaea were a swarm of pestiferous bandit hordes who, profiting by the country's helplessness, gave themselves to forays, looting, and plundering. Neither life nor property was safe, and the gloom of uncertainty hung like a pall over the land.

(9) An ever present incentive was the Messianic Hope. This hope, a heritage from early times, ever served to keep the people elated in spite of suffering. In Jesus' day this had been worked out very fully, and indeed one cause for the Jews' stumbling at the claims of Jesus was the seeming incompatibility of the course of his life with the expected Messianic program. Eager eyes were turned toward every newcomer and toward every unusual train of events in the hope that this one might prove to be the Messiah; at least this was true of the body of the people.

Despite all these calamities and the terrific struggles with Rome, in which unequal conflicts Judaea was matched only in sublime courage and fanatic zeal, the spirit of Judaism survived. First at Jabne, and then in Lydda, Usha, Tiberias, and far away Babylon such as had not fallen victims to the fury of Rome, aided by a rigid espionage, gathered to collect and to teach the Law. In the Lyddan assembly Ishmael on the ground that the Torah existed for life rather than for death, advocated that one might transgress the Law to preserve life. The final vote enacted that to avoid death by torture all laws might be broken save those forbidding idolatry, adultery, and murder. There was a considerable party, however, that stood for the letter of the law regardless of consequences. It seems a fair inference that the Torah as it appears c. A. D. 200 was essentially in force c. A. D. 30, barring such additions as were evolved from the changing environment of the Jewish community.

History of the Case

It matters little whether the first hearing was before Annas. It might well have been. That old fox, one of the smoothest and most dastardly of ecclesiastical politicians, kept the high-priestly office in his family for a long term of years. Annas was himself high-priest for seven years, and lived to see the office held by five sons[19] and a son-in-law, Caiaphas; further, this was a Sadducaean family, and represented the aristocratic, oligarchic, and Hellenizing faction of Judaea. Their pious zeal in the light of the facts is the more sardonic. It is not likely that we have any report of this first hearing of Jesus, Jo. 18:19-23 probably following vs. 24 in harmony with the other Gospels. Before Caiaphas Jesus appeared without advocates or accuser. The judge proved his accuser. On two points the high-priest interrogated,—as to his disciples, and as to his doctrine. To the first query the prisoner answered never a word; to the second he declared that his teaching had ever been in the open, and further challenged the verdict of any who had heard him. The attempt having produced nothing, evidence was sought. These witnesses[20] were too bungling to be collusory, altho condemnatory evidence was the kind sought. The pliant rabble was in evidence. Every utterance of the accused was possible plunder. At last two witnesses hit upon a common point. It was the conversation between Jesus and the Jews after the cleansing of the Temple[21]: "Destroy this temple, and in three days I will raise it up." Tho spoken of his own body the words were interpreted by his interlocutors as applying to the national temple. These words if uttered against the abode of Yahwe might be construed as blasphemy. Even here the witnesses failed of agreement. Again the prosecution failed and a new tack was tried. Rising in his place, the High-priest called upon the accused in the name of the great God of Israel to plead to the charges preferred. The command now was from Yahwe thru his vicegerent. Silence was no longer possible. The reply was not only clear: an apocalyptic verse is added:

"Henceforth ye shall see the Son of Man sitting at the right hand of power, and coming on the clouds of heaven[20]."

In the light of what precedes there was only one meaning for these words. Jesus stood guilty of blasphemy. With tragic gesture[22] the High-priest pronounced judgment, and there was a common voice

19. Jos.: Antt., XX, ix, 1.
20. Mt. XXVI: 64.
21. John, II: 18-22.
22. Sanhedrin, VII, vi.

for the death penalty. The three synoptists agree that the accused was now subjected to the buffets and abuse of the crowd[23].

The morning trial was a formality to satisfy the exactions of their law, which forbade nocturnal trials for the capital cases. It may be, too, that such a meeting was necessary to meet the legal requirements of a full bench. Accepting Luke's statement[24] as not being a repetition of the night trial as described by the other synoptists, the Sanhedrin rendered its verdict by daylight as required, but were still culpable of instituting proceedings by night. In case these statements are identical, there being in Luke an error of time, the court stood guilty of both offenses. One thing is certain: Jesus was declared guilty of blasphemy. The testimony of Judas to his Master's innocence was passed over. It is not likely the evidence was desired. Further, Jesus had declared himself, and in the light of his own utterances the court did not see fit to reopen the case. It is clear that the charge preferred before Pilate was that of treason. The indictment may be summed up under three heads: (1) seditious agitation, (2) forbidding tribute to Caesar, (3) assuming the title of King. In the former trial Matthew and Mark brought the evidence: now it is our third evangelist who furnishes detail. The evidence presented is a garbled account of a previous conversation on the question of tribute. Jesus' reply was falsified into a repudiation of tribute.

The Roman governor saw in the occasion nothing more than a theological squabble, and soon perceived that the battle already was to the death. After hearing the prisoner's declaration that his Kingdom was not of this world, Pilate unequivocally declared the charges unfounded,—at least there was no indignity offered Rome. It is difficult to appreciate the governor's attitude, as it is also to many to interpret the attitude of the pro-consul Gallio nearly a quarter of a century later. Pilate as a representative of the Emperor and as a custodian of the peace, regarded the entire matter with contempt. Yet, tho he doubtless despised the Jewish rabble, he did not court unnecessary responsibilities. Accordingly, he gladly learned that Jesus was a Galilean and immediately remanded the prisoner to Herod.

The trial before Herod availed nothing except to flatter Herod and to foster a political friendship between the two governors. Jesus is sent back to Pilate who now faces without alternative inexorable

23. The three points concurred in by all three are that the trial occurred before the High-priest, that the accused was mocked and buffeted, and that a morning trial followed.
24. Luke, XXII: 66-71.

fate. Like British provincial rulers of the last two centuries Rome had learned the wisdom of catering to local beliefs and prejudices. Pilate was now face to face with what he most dreaded, an infraction of Jewish theological law—which he could but little understand—and the possible charge of condoning treason. A second and third time Pilate urges the release of the prisoner in keeping with a time-honored custom. The fickle crowd inconsistently calls for release of one of whose treasonable purpose there can be no doubt—Barabbas. The insincerity of the prosecutors is apparent. Had they been jealous of Caesar's honor, they would never have released Barabbas. Had they been fair, they would have accepted a Roman governor's verdict. Had they been consistent with their wonted attitude, they would have left it to the governor to prefer charges.

The leaders of the mob now had recourse to a well-known law—the right of direct appeal to the Emperor. "If thou release this man thou art not Caesar's friend." While in office a proconsul's power was supreme within his realm. As an ex-officer he could be called to account and even before the expiration of his term of office he could be accused to the Emperor by the provincials of enormities and irregularities in administration. Many a Roman orator thus won his way to fame and many a Roman official went into exile. Pilate recognized the menace. He faced two perils: the horrors of an Oriental mob, and the charge to the Emperor of being party to treason.

After further decision as to the prisoner's innocence, after spectacular demonstration of his convictions, the governor yielded to the mob, violated his sense of justice, confessed his impotence, belied his verdict, and ordered the Roman guard to the performance of what Roman law expressly and explicitely forbade—the execution of an innocent man, and in further violation of law the torture of a prisoner under sentence. In light of the foregoing we urge repeated error and travesty on justice. We beg to file a demurrer.

The Brief

(1) The court erred in that the fundamental requirements of Jewish law were not observed.

(a) The early morning trial, much more the nocturnal hearing in the house of Annas, was illegal, the law forbidding afternoon trials or procedure before the morning service.

(b) The morning trial was prejudged by the earlier hearing, and in so far was not a formal trial.

(c) The verdict of guilty was pronounced on the same

day with the trial, contrary to the holding of the Jewish law.

(d) The court posed as prosecutor rather than as judge. There was no stated accuser, no advocate, no citing of witnesses for the defendant despite the prisoner's challenge,—"Openly I have spoken in the Synagogue: ask those who heard me."

(e) The person of the accused was not protected from violence, the bystanders being permitted to strike and torture.

(f) The required formality was not observed, the formal pronouncement of the sentence not being made by the judge.

(2) The Court erred in presenting a garbled charge. The original charge of blasphemy based on a distorted report of a saying of Jesus was dropped for one that the authorities felt would appeal to Rome, viz., sedition and treason. In the face of this last the authorities asked for the release of a man held on the same charge and who to insurrection had added murder.

(3) The Court erred in permitting unseemly haste, the law forbidding execution on or on the eve of a feast-day.

(4) The Court erred in that the death-sentence was passed tho the Roman governor refused to prosecute and the Jewish authorities had no jurisdiction, no power or authority for capital punishment.

(5) The Court erred in that contrary to the genius of Roman law, an innocent man suffered punishment. Herod by dismissing the case tacitly acknowledged the innocence of the prisoner: the Jewish authorities confessed they had no jurisdiction: Pilate repeatedly declared the prisoner innocent and that Rome found no ground to prefer charges. The offense, if such there was, was against Jewish theological law, and the utmost penalty possible would have been of the nature of excommunication or expulsion from the Jewish ecclesiastical body.

(6) The Court erred in that a sentence—not formally declared or passed—was permitted for political reasons, the Roman governor in violation of his trust permitting certain priestly leaders and a clamorous mob to carry out a sentence not passed but permitted, and that to avoid facing a riot in Jerusalem and personal charges before the Emperor at Rome. Pilate's final consent was in contradiction of his verdict.

Conclusion

Where then can the blame be placed? Not on the Roman soldiers for they only obeyed orders, and the zeal they manifested was

that of a brutal soldiery. Nor can it be charged to the Jewish nation for they were not concerned save two classes: (1) The High-priestly political ring and (2) the rabble, that ever-present, inexplicable, and deadly menace to established order. Whether or not mob-psychology permits moral accountability, the mob is ever a blood-thirsty thing ready to follow the leader that ministers to its beastly desires whether Caiaphas or Robespierre, whether in Jerusalem, Paris, Liverpool, or Chicago. The blood of the innocent rests at the doors of a religio-political hierarchy and the cowardly representative of a bloody Nero. Overawed by trial and probable exile, the Roman played into the hands of a ring of cunning tricksters who knew the ins and outs of the game and played their cards with fatal sureness.

As a final caveat it must be urged in favor of the Hierarchy that for nearly a century Judaea had been distracted by revolutions, many of them Messianic in character. Hence jealousy was easily augmented by fear. On the other hand Rome tho seeking justice was often, as in the present case, the victim of its own machinery and thus struck gropingly in the dark.

BIBLIOGRAPHY

Bouche-Le Clerq: Manuel des Institutions Romaines.

Edersheim, Alfred: Life and Times of Jesus, the Messiah.

Graetz, Heinrich: History of the Jews. Eng. trans., 6 vols. Phila. 1891.

Greenidge, A. H. J.: The Legal Procedure of Cicero's Time. Oxf. 1901.

Josephus: Antiquites.

Mommsen, Theodor: Römisches Strafrecht. Leip. 1889. Also Mommsen—Marquarlt. Handbuch d. Römischen Altertümer.

Schuerer, E.: Geschichte d. Judischen Volkes im Zeitalter Jesu Christi. 3 vols. and Index. Leip. 1898-1902 (4th Edn. 1907)

Talmud (Sanhedrin). Eng. trans. Rodkinson and text ed. Weiss. Imperfect but best in English.

Zoeller: Römische Staats u, Rechts—Altertümer.

Book Reviews

RURAL LIFE AND THE RURAL SCHOOL: JOSEPH KENNEDY, Dean of the School of Education, University of North Dakota. The American Book Company, Chicago, 1915. 189 pp. Price, eighty cents.

It is a difficult task for one to review with unbiased mind a book written by a dear and long-time friend. We are frank to admit that there is a predisposition in our mind to commend anything which Dean Kennedy may do, say, or write, because we have learned thru years of intimate association that few educators are possest of more sanity and common sense than he.

Much has been written of late on the problem of Rural Life and the Rural School, yet we doubt if any author can speak out of a larger experience with this rural school question than Joseph Kennedy. As a boy in the country, he received his elementary education there. Having had experience as a teacher of country schools, as a county superintendent of schools, as an institute conductor, as dean of a School of Education in a State university, and as a thoro student of education, he brings to this discussion a life-time experience in dealing with the problem at hand.

In the first three chapters of this book, he treats of the life of the boy or girl on the farm, the attractive forces of the towns and cities, the difference between the real and the ideal school. In this latter discussion, he says: "Where a good rural school exists, whether non-consolidated or consolidated, it should be the center and the soul of rural life in that community—social, economical and educational." In the following chapter (IV), he points out the lines of progress on the farm and in education. He directs attention to progress in higher education, in the normal school, in the agricultural college, and in the high schools, and concludes by saying that the rural school has not kept pace with this progress because it is the last to which public attention is directed. He thinks the rural school presents a backward or neglected field; and that it is the same with the whole country over. This statement, we think, is just a bit over-emphasized. Having given some years to this work, we are quite of the opinion that much, very much, has been accomplished in the past ten years especially along all lines of improvement of the rural school; yet we frankly admit that the one overshadowing difficulty is correctly stated by Dean Kennedy; namely, that it is a question of teachers. There must be higher standards

and there must be better compensation, but even here we believe much has been accomplished.

Consolidation is discust in Chapter VI, but because of the general information concerning this matter, it is needless to restate here what is presented by the author, except that we would emphasize with him the limits of transportation (five or six miles), and urge the largest possible consideration of the question by each district before action.

Dean Kennedy wisely says that the teacher is the greatest factor. This is true from kindergarten to university, in town and in country. We quote his definition of education: "Education is essentially and largely the stimulation and transformation of one mind or personality by another. It is the impression of one great mind or soul upon another giving it a manner of spirit, a bent, an attitude as well as a thirst for knowledge."

Under the head of The Three Inseparables, he says there is no profession of teacheing in the lower ranks of the teachers calling. His three inseparables are: (1) Personality, (2) High Standard of Qualifications and (3) Respectable Wages. The present plane of inefficiency of the Rural Schools cannot be lifted until our conceptions on these three points are revised. Present conditions result in the survival of the "unfittest." We must raise standards first, pay proper wages, then the stronger personalities and well qualified teachers will be forthcoming.

The curriculum of the Rural School needs much attention. There must not be weak imitation of city life. The Rural School has a rich environment, and the Rural School must interpret education largely in terms of rural life, and that again, means teachers who know the country. He does not believe in the hard and fast course of study and endless red tape frequently found in connection with Rural School supervision. His closing paragraph in this chapter is so typical of Dean Kennedy's style, we wish we could give it all. He says again the teacher is the chief factor. "He is the living fire at which all the children must light their torches." Without strong teachers there is no hope.

There is a helpful discussion of the social center idea, followed by a plea for better and more adequate supervision. The author says that it is fully as important as teaching. There should be a supervisor for every thirty or thirty-five schools.

In the chapter on Leadership and Co-operation, he touches the real essence of success in any field of endeavor. Without these two elements, no enterprise will succeed. The teacher must furn-

ish leadership, and then there must be co-operation in order that the Rural School may become an efficient instrument in education. He thinks it is possible for an intelligent and successful farmer and his family to lead an ideal life, and so it is; there are hundreds of such, right here in North Dakota.

His concluding chapters on The Rural Renaissance and A Good Place for All, call attention to the fact that the present wide-spread discussion on Rural Life in all of its various phases must have but one result; namely, a re-awakening of interest in, and a large appreciation of, the importance of the man and the woman on the farm in the open country. He says it is the finest life on earth. This is his conclusion: "The real vital possibilities of country life are without number. The surface attractions of the city, are most alluring. A focusing of the public mind upon the problem, its pros and cons, will, it is to be hoped, turn the scales without delay in favor of country life and its substantial benefits."

Dean Kennedy has made a substantial contribution to this whole discussion. His book is well arranged and well written in that inimitable style which is his, with a fund of good illustrations to clinch his points. The book is well worth while, and it is entitled to a permanent place in the literature bearing upon this most important phase of public education today.

WALTER L. STOCKWELL
State Superintendent of Public Instruction of North Dakota 1903-1911.

PLAYS AND RECREATION FOR THE OPEN COUNTRY: HENRY S. CURTIS, Former Secretary and Vice President of the Playground Association of America. Ginn and Company, Boston, 1914. XVI+266 pp. Forty-one half-tone illustrations.

EDUCATION THROUGH PLAY: HENRY S. CURTIS. The Macmillan Company, New York, 1915. XX+360 pp. Nineteen half-tone illustrations.

Play and Recreation, by Henry S. Curtis, published by Ginn and Company, is a discussion of the movement applied, as the auther indicates, to the open country. This book, taken with Mr. Curtis' *Education Through Play,* fresh from the Mecmillan Company's Press, makes a complete survey of the value and scope of the Play and Recreation Movement; the latter book dealing with modern conditions in cities.

Play and Recreation shows that play is not only the most natural and persistent instinct of childhood, but that *play* is the *work* of childhood. Properly and intelligently guided thru growth, the child makes the transition from play to work at the same time, gaining as much thru experience in play, while the body is developing, as he does thru school experience, where the mind is undolding. Furthermore, Mr. Curtis shows the tonic necessity of fostering this same spirit in men and women with whom increasing responsibility tends to stifle the still natural instinct for recreation.

Mr. Curtis believes that recreation should be part of the routine of life. The mother of the family is the natural director of the indoor pleasures of her family. The father's duty is to see that outside games are available, suitable to the season and country. With great sympathy for the needs of growing boys and girls, the author also points to the neglected social opportunities of the elders in rural communities. He thinks that every family should do more to make its home a convenient, enjoyable place. In his chapter on "Some Experiences That Every Country Boy Should Have", Mr. Curtis shows the necessity of giving every boy a chance at hunting, fishing, swimming, climbing trees, robbing bird nests and bee hives, etc. He believes that every boy should have a safety-gun and that farmers would do well to put bounties upon the pestiferous birds and beasts that hinder the farmer. The aim of this chapter in encouraging a virile, rather than a sentimental, attitude toward living things is commendable. It is a question, however, if all the suggestions on the matter of extermination should be taken without more scientific investigation. The largest bounty is suggested for the hawk and owl. We know of a recent altercation between North Dakota farmers upon the prey of the hawk, when he swooped upon the chicken yard. A hawk was shot and in his talons was found a large rat which had come to take the young chickens. The farmer's good friend was dead.

But the best of this book is that it shows what is most valuable in life, and how best one can go about the matter of improving conditions for play and recreation, the one thing that is needed to keep young folks away from the cities, and keep farms in the hands of owners who will develop and not exploit them.

Mr. Curtis believes in directed play being part of the school system wherever possible, but discussion is given to other possibilities. Particularly successful is the consolidated school in dealing with recreational work, as it is there possible to develop many of the attendant features, such as play festivals, corn clubs, and child-

ren's fairs. The Y. M. C. A. and Y. W. C. A. have done valuable service in bring forward the Boy Scout and Camp-Fire Girls organizations, which are doing much to broaden and color life for young folks. Mr. Curtis wants to make social centers of the schools as far as possible, believing that they bring together children and parents in most democratic relationships. He believes that social centers are the cure for rural isolation, that they are crucial to the larger education of the farmer and his wife—that they are the means of providing not only needed recreation and social life, but also assist in the organization of the farm community for various co-operative business and social enterprises.

Mr. Curtis points to the extension movements in rural districts, of the Departments of Public Instruction, the state universities and agricultural colleges and the tendency of taking much to the people that they cannot afford to leave their farms to get. For example of this work, he pays tribute to the work in Barnes County, North Dakota, where the county superintendent, Miss Minnie Nielson, has been unusually successful in developing a school of dairying and domestic economy for a group of one hundred and fifty girls chosen as the best of their respective rural schools. A similar encampment for boys under Mr. Thomas Cooper of the Better Farming Association of North Dakota has had similar success. In the Boys' Chautauqua, lectures and entertainments, as well as baseball and swimming, served to stimulate these farm boys.

This book upon *Play and Recreation* furnishes a valuable handbook to any one interested in developing this work. Practically every phase of rural situation is discust and the means for introducing a system shown. Moreover, the play and recreation feature of future rural life is so woven into the practical, that one cannot make a study of the book without recommending its examples, not only for the well-being, but the success of the dwellers in rural communities.

MABEL S. MCVEY

SOCIETAL EVOLUTION: ALBERT GALLOWAY KELLER, Professor of the Science of Society in Yale Univerrsity. The Macmillan Company, New York, 1915. XII + 338 p. Price $1.50 *net.*

The theme of Professor Keller's new work is the application of the Darwinian principle, including variation, heredity, selection, and adaptation, to the mores of a society. The term mores, which was popularized by the author's predecessor, Professor Sumner,

is used comprehensively to mean the psychological content of a civilization. Tho a less abstract term, it has somewhat the same meaning as the term achievement as used by Ward, or the German term Kultur. It is shown that society in developing from its basis in animal life continued the natural process of evolution not so much on the physical plane as on the plane of adaptive habits that are transmitted from generation to generation by imitation, and that gradually rise into the realm of rationally selected ideas. It is further made clear that the Darwinian principle is not applied to the psychological content of society as a mere analogy, but that there is a real conflict and selection among the mores out of which the higher adaptations of society are developed.

The author first describes the characteristics of the mores, beginning with their first manifestations as folk-ways among primitive peoples. The folk-ways are conventional usages arising not so much from human purpose and wit as from trial and error successes at adaptation. They are like instinct in their irrational appeal, but in reality are forces controlling and repressing instinct. Under the stress of the conflict with environment the mores have always shown the same tendency to vary as is exhibited by organic life. Between the variant types there ensues a struggle, in one form or another, from which selection results. A universal primitive form of this selection is the group struggle, by which one group is destroyed or assimilated by another. Later the selection approaches a more rational choice of the better adapted types, as is shown, for example, in the spread of inventions among peoples on the stage of culture, or again in a social way in the working of modern popular government. Of all the mores those related to the acquiring of a living are to be regarded as basic, while the others form a somewhat coherent system built upon the economic foundation. It is also in the economic mores that change is most readily effected, since the test of validity is here most direct. Hence progress is likely to be first of all economic, and later to affect the political, religious, esthetic and related mores. As an illustration it is shown that democracy grew naturally out of the economic conditions of frontier life. Another illustration is the development of the form of marriage as related to property. The position taken is well summed up in the sentence: "The code of the maintainance organization is the dominant chord vibrating to the tone of the struggle with nature and fellow man; the rest of the mores are, as it were, overtones of that chord." This is, of course, economic determinism, but it is without that exaggeration which has often made the doctrine objectionable.

Under the subject of counter-seltction the biological foundation of society is considered. It is shown that it is, after all, normal in social evolution that biological natural selection should be in part suppresst. Society sets up its own standards of selection, and preserves many individuals who in the natural struggle would perish as weaklings. Yet it is admitted that counter-selection may be so directed as to endanger society. The recent demand, therefore, for a certain degree of rational biological selection in society is well founded. Society is, as it were, built upon a scaffolding with the biological substratum as its foundation. The higher the scaffolding is pushed, the more the necessity that the foundation should be secure.

Under the subject of transmission, it is shown that the mores are transferred from generation to generation in a manner that parallels the process of biological heredity, as is exprest in the term social heredity. In the process of acquiring the mores of his group, the child passes thru a recapitulation of the principal stages of the evolution of the larger society. Cross transmission resulting from prestige, and carried thru the channels of commerce and in other ways, is discust along familiar lines. The latter part of the book is given over to illustrating the process of social adaptation under such environmental conditions as the frontier and the city, in order to show that there is a progressive change in the mores worthy of being called an evolution.

Professor Keller has followed the line of social theory laid down by Professor Sumner, but he has not exhibited the latter's attitude toward present-day problems that has offended many progressive minds. The book is of especial value as a corrective of an exaggerated biological view of society which has currency today.

G. R. Davies

Department of Sociology,
University of North Dakota

A Historical Introduction to Ethics: Thomas Verner Moore, Instructor in Psychology at the Catholic University of America. American Book Company, New York, Cincinnati, Chicago, 1915. xii + 164 pp. Price eighty cents.

This book is the elaboration of a series of lectures delivered at the University of California and at the Catholic University of America. The author has selected the ethics of various philosophers as types of the different ethical theories and about them has

constructed a history of ethics. The system of each writer is taken up as a unit being first introduced by a gist of his ethical philosophy, followed in each case by a brief biographical sketch and a short analysis of the special points in his system. The discussion of each system is concluded y a special bibliography.

This method of treatment is commendable and besides being a contribution to the construction of texts on the subject of ethical history saves the work from the usual amount of logical confusion. But it must be said that the treatment is often too brief and that the bibliography frequently omits the names of important writers and carries the names of minor ones.

The following comparisons are given to show that the contributions of some of the great writers are not properly evaluated in the history: As much space is devoted to St. Thomas Acquinas as to Socrates and Plato combined, more than to Kant, six times as much as to Spencer, and twice as much as to Aristotle. This is out of proportion to the importance of Aquinas in ethical history.

Ocasionally the work manifests an unsafe psychology. One instance is in the discussion of the moral sense where "perceptions of reason and those of sense" are mentioned. Another instance is the statement of the author that when the wrongness of an act is self-evident, e.g., murder or theft, it is perceived by "simple intuition", thus unnecessarily departing from his sound view that moral judgment is simply the same power that judges weights, values, and distances functioning in another way. Murder and theft are not fundamentally self-evident.

One does not fail to note that the present history of ethics does not mention psychological ethics and its exponents.

JOHN W. TODD

Department of Psychology,
University of North Dakota

University Notes

High School Conference of 1915 For fourteen years the school men of the state have been coming to the University in the month of May for conference and discussion of educational matters. The meeting of this year was largely in the nature of a round table given over to specific problems of high school instruction. More than fifty different towns were represented by seventy-nine supenintendents and principals. The meetings consisted of two sessions, on Friday afternoon and Saturday morning. The Schoolmasters' Club of the state held a meeting on Friday morning, listening to a report on the need of standards to test educational work in the schools. While distinctly successful, the Conference was interrupted in its most serious work by the many events of the two days. It was proposed that the University provide during the Easter vacation a short course for superintendents and principals. It was thought that under the direction of men of national reputation in public school education much could be accomplished in bringing the superintendents and principals of the state in direct touch with the experiments being tried elsewhere. The University looks favorably upon such a proposal and if possible will endeavor to provide a course of this kind next year.

The Conference discust the modern language problem and recommended to the State Board of Education the extension of modern languages to three years as a constant for the schools. It was evident, too, from the discussion, that many favored an extension of such instruction to the grades in the seventh and eighth years. These are good signs. Committees were appointed to revise the syllabi in English, Home Economics, Manual Training, and Music. A new committee was appointed, to report in October, at the meeting of the State Educational Association, on the possibilities of cooperation in visual instruction.

In closing the meeting the Conference gave expression of its high regard for Mr. Richard Heyward, the secretary of the Conference for several years, who now retires from the office of High School Inspector and as a member of the State Board of Education.

North Dakota Academy of Science The seventh annual meeting of the North Dakota Academy of Science was held at the University on Friday and Saturday, April 30 and May 1. The two-day session was an innovation this year that proved very satis-

factory. The program has shown each year a progressive development in the number and character of the papers presented, and this year there were some twenty-two papers, and two special lectures by Dean E. P. Lyon of the University of Minnesota.

The officers elected for next year are Miss Lura Perine, Valley City Normal School, President; Dr. A. H. Taylor, University, Vice President; Dr. G. A. Abbott, University, Secretary-treasurer; and Professors Daniel Freeman, Fargo College, and R. E. Doneghue, Agricultural College, as additional members of the executive committee. The next meeting will be held at the Agricultural College.

Intercollegiate Track Meet The Fourth Annual Minnesota-Dakota Conference Track Meet was held at the University May 28 and 29. This is the most important track and field event in the Northwest, and is rapidly improving in quality as shown by the fact that nine new records were set this year. M. M. Delaney of the Chicago Athletic Club acted as referee and starter and conducted the meet to the entire satisfaction of all concerned. Hamlin College and the University of North Dakota were close contenders for first place and it was only by winning the last event, the relay, that the former won first place with a total of 49 points. The University was second with 44 points, South Dakota State College was third with 28½, and the University of South Dakota was fourth with 16.

Scholarship Rankings Some two years the University instituted the custom of publishing the scholarship ranks of the different residence halls and of the fraternities. These marks are based on the average number of honor points per hour credit received by the group. A grade of A carries with it 3 honor points, B, 2, C, 1, D, 0. The last chart published shows the average for the whole years of 1912-13 and 1913-14 and for the first semester of 1914-15. Altho the data have not been presented for a sufficiently long time for broad generalizations, there are a number of tendencies that are evident and interesting. The first and most obvious fact is that the University average is rapidly and steadily rising. This has two possible explanations—there has been either an absolute improvement in scholarship, or a progressive "degradation" of our marks. A faculty committee is studying the entire subject of a marking system and will undoubtedly determine this point. Obviously the University average cannot increase indefinitely, but must fluctuate slightly about a so-called probability curve, that

is, when a large number of people are subjected to any reasonable test and graded acording to their performances, about 40 to 50 per cent will do reasonably well and be graded C. On each side of this group will be other groups of 20 to 25 per cent each, the upper one being distinctly superior to the average and graded B, the lower one being somewhat inferior, but still passible, and graded D. Then on each side of these groups will be much smaller ones of 5 to 10 per cent, composed on the upper side of brilliant and exceptional students graded A, and on the lower side of those who quite failed to pass the test and graded F. On this basis the percentage of A, B, C, etc., for any large number will vary within the limits set, altho the absolute standards may be changing.

The averages for the residence halls without freshmen are all above the University average and the freshmen in the residence halls are all above their class average. The fraternity average as a whole is 1.46, is distinctly above the University average, and is increasing more rapidly. It may also be stated, tho not shown on the graph, that two thirds of the individual members of the fraternities average above the University, so the high fraternity average is not due to a few good students. The average for the sororities is much above that of any group of equal members in the University. These conditions are a normal thing at the University of North Dakota, because fraternity members are a group selected for some reason or other, and since scholarship has become a good reason, the fraternities should average above the University.

The publicity given to the rankings, and the healthy rivalries resulting therefrom, have resulted in a selective process being applied to the residence halls as well as the fraternities, which accounts in part for their standing, but the fact of the relatively high average of the students in the residence halls and the fraternity chapter houses clearly indicates that life among the distractions of "downtown" is not conductive to the highest scholarship, tho of course there are individual exceptions to prove the rule.

As is to be expected, the freshmen average was rather low the first semester due to the inability of the University to assimilate all the raw material, but it will undoubtedly improve this semester. The beneficial effect of the delayed pledging rule adopted by the men's fraternities this year is shown by the fact that the freshmen in Budge and Sayre, from whom most of the fraternity material is drawn, showed a good increase in spite of the fact that the class as a whole decreased.

The very good spirit in which the publication of these marks

has been taken, and the undoubtedly good effect which they have had on scholarship should make this an established custom at the University of North Dakota, and lead to its extension to cover the different departments of the University and such organizations as the various athletic teams and the musical and dramatic clubs, so that we may know the facts in regard to our "extra-curriculum" activities and their effect on scholarship.

Interscholastic Track and Field Meet The Interscholastic Track and Field Meet held May 21st and 22nd was the most successful contest of its kind ever held at the University. There were some 114 entries from 23 schools, and over 800 people were on the field on Saturday afternoon. Altho the weather was cold and cloudy on Friday, Saturday was almost ideal, the new grand stands and fences facilitated handling the crowd, and all the events were carefully arranged before hand and carried out according to schedule.

Grand Forks High School won first place with 50 points, Cavalier was second with 37, Pembina third with 14, and Drayton fourth with 11. Grand Forks also won the relay. Fisher of Cavalier was the individual point winner with 23 points. Previous records were broken in the pole vault, javelin throw, shot put, and relay.

Hazlett Lectureship in Wesley College Wesley College brought to North Dakota this year as the Hazlett lecturer Professor Harry F. Ward of the department of social service of Boston University School of Theology. Professor Ward is widely known as a leader in Christian social service, having spoken in almost every state in the Union in the interests of the Methodist Federation for Social Service, of which he is secretary. In preparation for this work he has enjoyed liberal collegiate training, a varied experience in actual social service in several cities, and has reached a large audience thru his writings. During his recent visit in North Dakota he spoke at Grand Forks, Valley City, Fargo, Jamestown, and Minot, beginning his lectures May fifteenth and closing May twenty-sixth. His general subject was "Christianizing the Social Order." In his addresses to the University at convocation on May fifteenth and again on May nineteenth he discust various phases of the modern labor movement, with which he showed a broad-minded and sympathetic familiarity. Perhaps his message can best be summarized by quoting the social creed which he wrote, and which was adopted by the general con-

ference of the Methodist Episcopal church in 1912. It is as follows.

THE METHODIST EPISCOPAL CHURCH STANDS

For equal rights and complete justice for all men in all stations of life.

For the protection of the family, by the single standard of purity, uniform divorce laws, proper regulation of marriage, and proper housing.

For the fullest possible development of every child, especially by the provision of proper education and recreation.

For the abolition of child labor.

For the regulation of the conditions of toil for women as shall safeguard the physical and moral health of the community.

For the abatement and prevention of poverty.

For the protection of the individual and society from the social, economic, and moral waste of the liquor traffic.

For the conservation of health.

For the protection of the worker from dangerous machinery, occupational diseases, injuries and morality.

For the right of all men to the opportunity for self-maintenance, for safeguarding this right against encroachments of every kind, and for the protection of workers from the hardships of enforced unemployment.

For suitable provision for old age of the workers and for those incapacitated by injury.

For the principle of conciliation and arbitration in industrial disputes.

For a release from employment one day in seven.

For a gradual and reasonable reduction of the hours of labor to the lowest practicable point, and for that degree of leisure for all, which is a condition of the highest human life.

For a living wage as a minimum in every industry and for the highest wage that each industry can afford.

For the most equitable division of the product of industry that can ultimately be devised.

The movement for which Professor Ward speaks is not alone confined to his denomination, but has its parallel in most of the other important religious organizations. It is a significant sign of moral awakening that the social questions of the day are beginning to receive a fair consideration at the bar of the religious thought

of the nation. Dr. Robertson in his management of the Hazlett lecture foundation has again brought to North Dakota a speaker with a timely and important message.

The Dacotah The Dacotah of 1916, the current issue of the biennial publication of the Junior Class, was issued Monday, May seventeenth. The issue is decidedly a credit to the Junior Class, and in particular to the managing board, of which Mr. Harrison Brown is editor-in-chief. The volume is dedicated to Dr. Melvin A. Brannon, now president of the University of Idaho, and formerly dean of the College of Liberal Arts of the University of North Dakota. On one of the first pages appears a full page portrait of President Frank L. McVey. The bulk of the work is made up of the usual class pictures and descriptions of student activities, serious and otherwise. The literary quality is good, the half-tone and press work leave nothing to be desired. It came from the presses of the Page Printerie of Grand Forks and reflects great credit upon that establishment. In all, the volume amply fulfills the aim stated in a foreword as follows: "If these pages recall to you a few of the many joys of your college life our purpose has been accomplished."

Panama-Pacific Exposition The State of North Dakota has a building and an exhibit at the Panama-Pacific Exposition at San Francisco. One of the most interesting parts of the exhibit is the collection prepared by Dr. Earle J. Babcock, Dean of the University School of Mines. It represents the mineral resources of the state together with their allied industries. Among the features of this portion of the exhibit are the divisions dealing with the work in the clays, in the coals, and in oil production. The state's resources and the tremendous possibilities in the development of widely varying industries are clearly evidenced. While the articles which are shown are representative of the entire state, no part of the exhibit is more interesting to the observer than the manufactures of the Ceramics Department of the University. In this portion of the display, a great variety of products is shown. They cover a field from high class art pottery, second only to Rockwood Pottery, thru large numbers of commercial articles to the common brick which the state is beginning to manufacture on a large scale. The advantage of North Dakota clays, in that the pottery can be made from the clays found in one locality without the admixture of substances brought from various places, is an important item. The art work done by

the Ceramics Department is excellent and, in addition to the rougher utensils, the exhibit includes fancy bowls, tea sets, and vases.

The University Glee Club

The Men's Glee Club this year has a regular membership of thirty-four. They rehearse twice a week in preparation for appearances at the various functions on the campus and for an annual trip which is usually confined to the State of North Dakota. The club has been recognized as the equal of any University Glee Club in the country. Out of the entire membership is selected a group of twenty-two to take the trips, selected on the basis of the greatest service to the Club. Each man has to be able to sing his part in quartet in any of the songs in the repertoire of the club. In this manner each man is made an independent singer and his full strength counts in the club work. This sort of "tryout" also serves as the semester examination in the course. Those successfully completing two years of work in the club and being taken on two trips are given a bronze medal watch fob. Those completing three years of work in the same manner are given a silver fob, and the gold fob is given to those completing four years of work and going on every trip. This year the Club appeared in some fifteen or more of the larger cities of the state. It is believed that these trips are rendering a good service. The young men are "farmed out" in the various private homes in the cities visited, and thus come in touch with the best families in each community, thus intensifying the interest of these families in higher education. It is gratifying to have more requests each year for dates than the club is able to fill.

An interesting innovation this year, in the matter of glee club work, is seen in the two short trips taken by the Girls' Glee Club. The young women acquitted themselves equally well with the young men, and were well received.

The Journal of Parasitology

A new claimant to attention in the field of scientific periodicals is the *Journal of Parasitology*, devoted to medical zoology. It is to be issued as a quarterly from the press of the American Medical Association. Two numbers, containing several interesting articles, have already appeared. The publication is intended to provide an opportunity for the publication of shorter papers on parasitology by American and other writers which hitherto had been sent abroad or have appeared in publications not especially designed for such work.

The list of foreign collaborators contains the names of twenty-six of the leading parasitologists thruout the world, while the Board of Editors is made up of twelve from the United States and Canada. Dr. Henry B. Ward, of the University of Illionis, is Managing Editor. Aside from the general interest common to all prominent institutions, the University of North Dakota is interested in the new movement from the fact that Dr. Robert T. Young, Professor of Zoology in this institution, is one of the editors.

The Psychological Clinic During the past five years there has been a marked increase of interest in the psychological clinic as a means of applying the science of experimental psychology to the study of children. There are now about forty psychological clinics in the United States, directly or indirectly connected with a psychological laboratory and in charge of men trained in psychological observation. Nearly every large city has its school clinic in charge of an expert who examines subnormal children for the purpose of grading and teaching them in a special manner.

The first psychological clinic in North Dakota was established last year in connection with the psychological laboratory of the University. Many clinics were held at the request of teachers and parents, while several university students took the freshman mental tests. Considerable interest was aroused so that this year the services of the clinic were sought by the public schools of the city of Grand Forks. The clinic is at present devoting its attention to those children who are not making the right progress thru the grades. The aim is to discover whether the retardation is permanent or temporary, to suggest methods for teaching and caring for the incurable, and to advise in what cases the cause of retardation is removable. In general it is found that the retardation is due to native incapacity, difficulties with the English language, defective senses, and irregular attendance. The first cause is the most usual. As there is a considerable foreign population in the city, the second is occasionally operative to lower the child's level. Irregular attendance is not a very important factor, because of the compulsory attendance law, and is usually due to the shifting of families, altho low mental grade naturally contributes something to this irregularity.

The clinics are held by appointment in the various ward school buildings of the city and in the psychological laboratory of the University. The work is in charge of Dr. John W. Todd who was trained in mental mesurements under Thorndike and conducted the Freshmen psychological tests in Columbia University from 1910 to

1912. The school clinics have the assistance of the records and the services of the school nurse, Miss Lelia Halverson.

Commencement Week The exercises of commencement week promise to be unusually interesting. As variations from the programs of former years, or as especially interesting features, are to be noted the visit of Dr. Webster Merrifield, president of the University for nearly twenty years, and the substitution of a commencement speaker for the usual student activities. Dr. Merrifield has been away from the University for a period of six years, and returns as guest of the institution during the week of commencement. Many of the alumni are planning to embrace the opportunity to renew pleasant acquaintance with their old loyal friend, the former president, and with their Alma Mater, thus made doubly dear.

The baccalaureate sermon will be given in the University gymnasium on Sunday afternoon by Bishop Frank M. Bristol of Omaha, Nebraska. The University Address is to be delivered on Tuesday afternoon by Dr. John M. Gillette, Professor of Sociology of the University, speaking on "The University in the Service of Society." Wednesday, June 16, is Commencement Day, long looked forward to as the culmination of the year and of the week. The speaker of the occasion is to be Dr. William R. Vance, Dean of the Law School of the University of Minnesota. In addition there will be the usual class exercises, alumni gatherings, Phi Beta Kappa initiation, Commencement dinner, etc.

The numbers to receive degrees and certificates from the various schools and colleges of the University are, as nearly as can be determined at this writing, as follows:

Graduate Department		4	
College of Arts		27	
School of Education:			
B. A. Degree and Bachelor's Diploma in Teaching	17		
Teacher's Certificate (Two years of college work)	38	55	
College of Mining Engineering		2	
College of Mechanical and Electrical Engineering		4	
Course in Civil Engineering		3	
College of Law		17	
School of Medicine:			
B. A. Degree and Certificate in Medicine (Two years of Medicine)	4		
Certificate in Nursing	3	7	119

Fellowships and Scholarships The Board of Trustees, following the custom of former years, and in order to foster the spirit of research, has provided the following fellowships and scholarships for the year 1915-1916: 1. One industrial fellowship in the School of Mines, yielding $400.00; 2. Three general fellowships yielding $300.00 each and available in any of the colleges of the University; 3. Three general scholarships yielding $150.00 each and available in any of the colleges of the University.

From many applications received from students and graduates from our own and other institutions, the Board of Trustees recently made the following appointments, upon recommendation of the University Council:

Alpheus W. Blizzard, B.S. (Ohio University, 1913), now Professor of Biology in Jamestown College, Jamestown, North Dakota, Fellow in Botany.

Edgar Gustafson, B.A. (University of North Dakota, 1915), Fellow in Sociology.

Harry Read, B.S. (University of North Dakota, 1915), Fellow in Physics.

Harry S. Moore, B.S. (University of North Dakota, 1915), Industrial Fellow in the School of Mines.

Arthur R. Thompson B.A. (Red Wing Seminary, 1912, and University of North Dakota, 1915), Scholar in Sociology.

Carl Gilbertson, B.A. (University of North Dakota, 1911), Scholar in Education.

Amanda Zabel, B.A. (University of North Dakota, 1915), Scholar in English.

University's Educational Standing I.—Classification of the University. In 1910 the United States Bureau of Education made a classification list of the universities and colleges in the United States. A year later this was modified and in this second list there were 496 colleges, grouped in four classes. Outside the University of Minnesota and Carleton College, the University of North Dakota was the only institution placed in the first class in the states of Minnesota, North and South Dakota, Wyoming, Montana and Idaho. There are only about 70 institutions in the first class.

II.—The Law School.

The American Law School association includes about 40 law schools. The law school of the University of North Dakota is a member of this association, which requires a high standard for membership.

III.—The Medical School.

The American Council for the Advancement of Medical Education classifies the medical schools of the country into four classes—Classes A, A+, B, and C. The Medical school of the University of North Dakota is ranked in Class A, as can be ascertained by reference to P. 670, of the Report of the Council for 1914. (Class A has a special group of schools, like Harvard University and the University of Pennsylvania that are classed at A+.)

IV.—The College of Liberal Arts.

In 1776 there was created at the College of William and Mary, at Williamsburg, Va., the society known as Phi Beta Kappa. Its purpose was to encourage scholarship in the best universities and colleges. This society now has eighty-six chapters, and one of these chapters was placed at the University of North Dakota in June, 1914. The granting of this charter was a national recognition of the scholarship and standing of the University of North Dakota.

V.—Entrance Requirements.

The entrance requirements of the University of North Dakota are the same as those of Minnesota, Wisconsin, Chicago, namely, fifteen units of high school work. The student is required to present that many units for admission. The University of North Dakota is a member of the North Central Association of Schools and Colleges, which requires the maintenance of high standards of admission, instruction, and equipment on the part of its members. Failure to maintain these standards means loss of membership.

VI.—Graduate Work.

The graduates of the College of Liberal Arts and the School of Education are admitted without condition to the graduate schools of the best universities. The University of North Dakota now has students in the professional graduate schools of the University of Chicago, University of Wisconsin, Columbia University, University of Illinois, and Yale University.

VII.—Relation to Foreign Universities.

Considerable difficulty has been experienced from time to time in the relation of students from American institutions who go to foreign universities for advanced graduate work. To facilitate this matter a committee of the Association of American Universities, upon the request of the German government, recommended one hundred universities and colleges in the United States to the German Minister of Education as maintaining standards of education which would admit their graduates to a given status in the German universities. In this list the University of North Dakota was included.

The Extension Division

UNIVERSITY OF NORTH DAKOTA

ITS AIM -- State-wide service of an educational character

ITS METHOD -- The distribution of educational advantages thru:

The conduct of University lecture and entertainment courses.

The development of publicity methods, giving the results of University research, and presenting the opportunities of education.

The establishment of correspondence courses for students thruout the state.

The conduct of municipal reference work in the interests of the towns and cities.

The encouragement of community institutes for the discussion of local problems.

The promotion of alumni organization and the service of the state thru the graduates of the University.

For full particulars, write

THE EXTENSION DIVISION,

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COURSES IN ENGINEERING

GIVEN IN THE

Division of Engineering of the University of North Dakota

I. THE COLLEGE OF MINING ENGINEERING:

1. The Curriculum. The courses give a broad technical and practical training for those occupations more or less closely associated with mining, metallurgy, milling, coal and gas engineering, cement, clay working, and other allied manufacturing industries.

2. Degrees. The four-year course leads to the degree of Bachelor of Science in Mining Engineering and an additional year of graduate work to the professional degree of Engineer of Mines.

3. Equipment. The equipment is high grade, including working models for making brick, pottery, and clay products, and for coal testing and treating, gas manufacture, etc.

4. Experimental Stations. At Hebron is situated a mining and coal and gas experimental station under the direction of the trustees of the University and the dean of this college. Here practical tests on a commercial scale are carried out.

Address, DEAN E. J. BABCOCK, University, North Dakota

II. COLLEGE OF MECHANICAL AND ELECTRICAL ENGINEERING:

1. The Curriculum. Courses are offered leading to the degrees of Bachelor of Science in Mechanical Engineering, and Bachelor of Science in Electrical Engineering. Five-year courses lead to the advanced degrees of Mechanical Engineer and Electrical Engineer.

2. Equipment. The shops are well equipped with the latest machines. The mechanical and dynamo laboratories have, among other pieces of apparatus, a fifty horse-power suction gas producer, and gas engine, and two seventy horse-power boilers, each with a different type of furnace, including an automatic stoker. The facilities for offering thoro courses in power engineering and in research work in the utilization of various types of power are ample and of the very best. The recent legislative appropriation of $17,000.00 for laboratory purposes has enabled the College still further to improve these facilities. For further information address

DEAN CALVIN H. CROUCH, University, North Dakota.

III. THE COURSE IN CIVIL ENGINEERING:

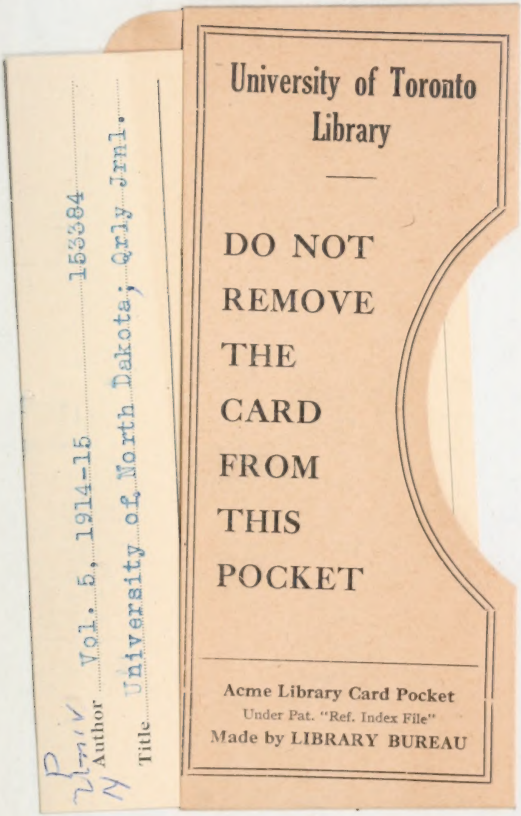
1. The Curriculum. The distinct professional lines to which attention is given in the course in civil engineering are the following: (1) surveying, (2) mechanics and bridge and truss stresses, (3) concrete construction, (4) railway location and construction, (5) hydraulics and water power, (6) sanitary and municipal engineering.

2. Degree. The degree of Bachelor of Science in Civil Engineering is conferred upon the completion of the four-year course. Upon the completion of the fifth year the degree of Civil Engineer is awarded.

3. Equipment. The equipment consists of the usual instruments for mesuring, testing, etc. Shops and laboratories of all colleges are open to engineering students.

Address, PROFESSOR E. F. CHANDLER, University, North Dakota.

For general information on all engineering courses, address the Registrar, University, North Dakota.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